POWER PLANT ENGINEERING

Established Over 32 Years

VOL. XXXII CHICAGO, NOVEMBER 15, 1928 No. 22

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Published on the 1st and 15th of each Month by the

Technical Publishing Co., 53 West Jackson Blvd., Chicago

New York Office, 171 Madison Avenue

Subscription price $2.00 a year in the United States and possessions. Canada $2.75 a year. Other countries $3.50 a year. Single copies 15 cents.

Copyright 1928, by Technical Publishing Co.

Entered as second class matter May 1, 1908, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

Member, Associated Business Papers, Audit Bureau of Circulations.

Circulation of this issue 23,900

When Helios Rides the Sky

NO LONGER is the sky sacred, its privileges limited to a few well meaning but vain and visionary characters. No longer does Belerophon ride his winged steed, Pegasus, without feeling the need of an aerial traffic cop and when Helios rides the sky in his chariot, he must keep a firm hold on the reins and a sharp lookout to avoid a collision with some young enthusiast out to break an altitude record.

Undoubtedly in times gone by, accomplishments of the old Greek gods were nothing short of miraculous, but our younger generation, although considering them interesting, would feel that they were decidedly old-fashioned. Today up-to-date Pegasus models are being turned out in hundreds of modern aeroplane manufacturing plants so that to children the aeroplane is as familiar as the automobile was to children of 15 to 20 yr. ago.

Power plant engineers have lost no time in taking advantage of the new science of aviation. It has been used to advantage by many companies principally for power plant and transmission line location. The picture at the top of the page is an aeroplane view of the reservoir and part of the town at Earlington, Ky. The narrow clearing at the upper left-hand corner of this picture is the transmission line right-of-way. The original contact print from which the half-tone was made had a scale of 1000 ft. to the inch and covered an area of about 1.5 by 2 mi.

Methods of taking and assembling the pictures, making the maps from these pictures and using the maps are given in an article beginning on page 1188. As a matter of interest, it might be mentioned that aerial photography was used in the preliminary studies of the new Powerton Station which is described on page 1198.

Chesapeake Bay District Served by Vienna Station

DESIGN AND ARRANGEMENT OF EQUIPMENT IN NEW 6000-KW. STATION REFLECTS LARGE STATION PRACTICE

VIENNA STATION of the Eastern Shore Public Service Co. is located at Vienna, Md., about 16 mi. northwest of Salisbury on the eastern shore of the Chesapeake Bay. It is situated directly on the Nanticoke River, from which it obtains water for condensing purposes and over which coal is transported and delivered to the plant.

As central stations go, the Vienna plant is a small one but its design, construction and equipment represent the most advanced practice and its engineering features would do great credit to many larger plants.

Having been completed early in the summer of 1928, the Vienna plant now supplies electric service to communities in Delaware and Maryland on the peninsula between the Atlantic Ocean and Chesapeake Bay. The 6000-kw. generating unit originally installed proved satisfactory to meet the load requirements, but to afford reserve capacity, another 6000-kw. unit now is being installed.

TRANSMISSION AT 22,000 V.

Current generated at 6600 v. is stepped up to 22,000 v. for transmission to distant communities. The station and lines all are built for 44,000 v. No switching is done on the low voltage side of the transformers, for the leads pass directly from the generator to the outdoor switching and transformer substation where the potential is stepped up to transmission voltage. The synchronization of generators is done on the high potential side of the transformers. Condensing water is available from the Nanticoke River and boiler feedwater is pumped from wells only 55 ft. below the grade.

In appearance the Vienna Station is an attractive structure built along the most modern lines and giving the impression of a plant having considerably more capacity than the 6000 kw. now installed. This will be evident from the accompanying photograph, which is a view taken on June 18, 1928, before the plant was completed. In accordance with modern principles of station construction, the boiler house has the largest volume and the turbine room is located between the boiler house and the electrical bay. The 44,000-v. outside switching and transformer substation can be seen at the left of the photograph.

PRESENT GENERATING UNITS RATED AT 7500 KV-A.

The major equipment of the plant consists of a 7500-kv-a. Westinghouse turbo-generator unit, with a C. H. Wheeler surface condenser and two 633-hp. Bigelow-Hornsby boilers equipped with Westinghouse underfeed stokers. Both forced and induced draft is employed and air for combustion is heated by means of a plate type air preheater. Among the engineering features peculiar to this plant is the arrangement of draft equipment in the boiler house. This, as may be noted in the cross-section drawing is practically all located below the boilers in the basement. This location gives easy access to the fans and driving motors and simplifies the duct layout. Air for combustion is drawn from the basement by the forced draft fans and delivered to the air preheaters above where it is heated by the flue gases. From each preheater, the air passes down through a vertical duct to the basement, thence to the wind box under the stoker. Flue gases, leaving the boiler, pass directly into the air preheater, through which they are drawn downward by the induced draft fans in the basement, which in turn discharge the gases directly to the stack.

Each boiler is provided with one Sturtevant forced draft and one Buffalo induced draft fan, each of which has two driving motors, one small motor for light loads and one large motor for full load. In the case of the induced draft fans the motors are as follows: large unit, 150 hp., 440 v., 3-phase, 865 r.p.m., Allis-Chalmers induction motor; small unit, 50 hp., 440 v., 575 r.p.m., Allis-Chalmers induction motor. The forced draft fans each are driven by a 25-hp., 440-v., 865-r.p.m. induction

Features of Interest at Vienna Station

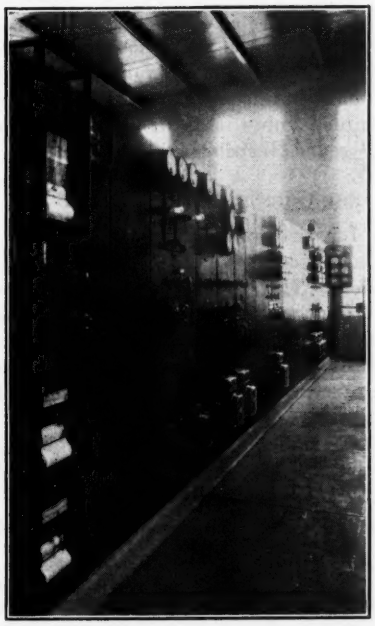


Fig. 1. A view of the 17-panel switchboard which controls all electrical circuits. The low voltage switches are in the basement below this board; the high voltage switches are outside in the outdoor switching station. There is no low voltage main bus installed, all switching being done on the high tension bus outdoors.

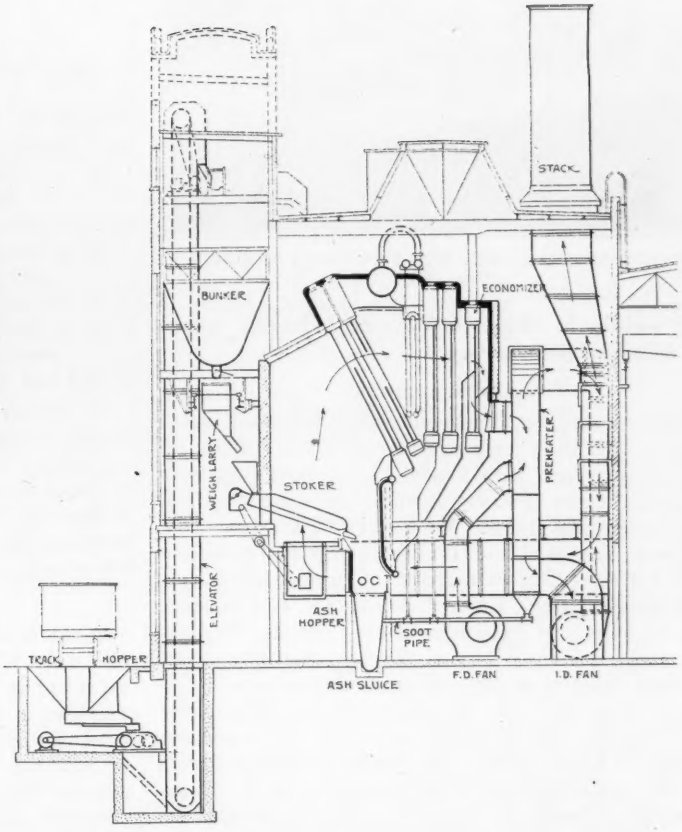


Fig. 2. Arrangement of boilers, draft equipment and coal handling apparatus is clearly shown in this cross section of the boiler room. All draft fans, it will be noted, are installed in the basement.

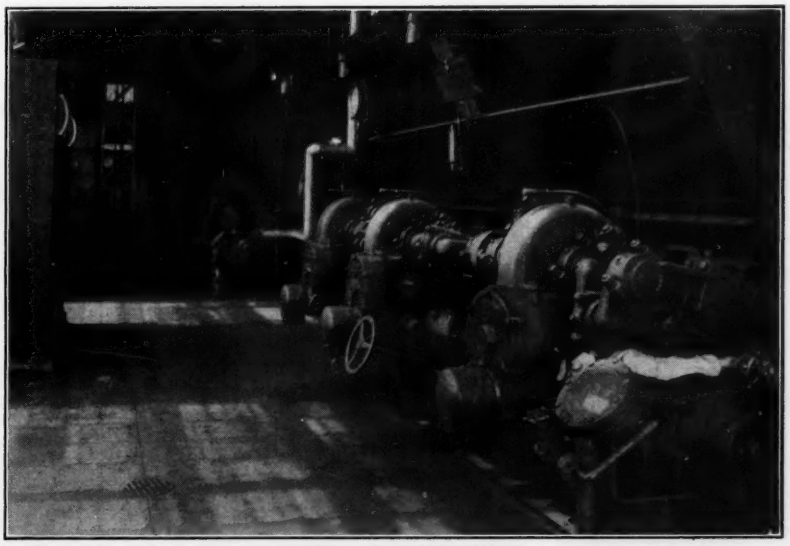


Fig. 3. Looking down the firing aisle in the boiler room. The stokers shown here are underfeed stokers each driven by a steam turbine which is built integral with the stoker itself. The main boiler control panel may be seen at the extreme left. All fan motors are controlled from this panel by means of push buttons.

At the far end of the boiler room can be seen the coal elevator. This as shown in Fig. 2 receives coal from the crusher underneath the track hopper and delivers it to a horizontal conveyor at the top of the boiler house. A weigh larry receives coal from the overhead bunkers and delivers it to either of the three stoker hoppers.

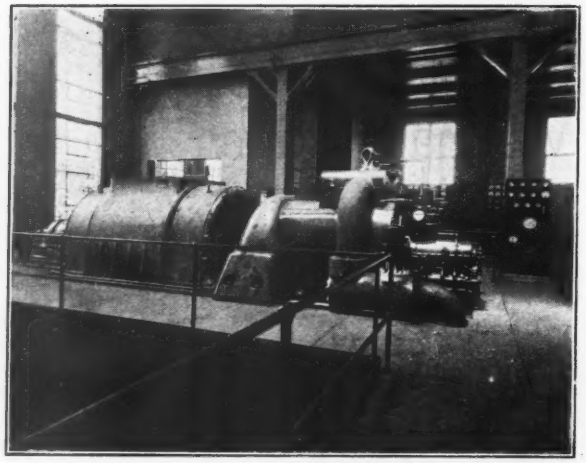


FIG. 4. SIX THOUSAND KILOWATT TURBINE GENERATOR AT VIENNA

motor and by a 50-hp., 1155-r.p.m. induction motor, both Allis-Chalmers units.

Boiler Equipment

Each of the two Bigelow-Hornsby boilers is rated at 633 hp. and built for a pressure of 355 lb. per sq. in. They are equipped with Foster superheaters and have the usual Bigelow-Hornsby integral economizer section. Boiler accessories include Yarway blowoff valves, Diamond soot blowers, Copes feedwater regulators, Ashton safety valves, (2 on each drum) Consolidated Superheater Safety Valves, Edward stop valves, and Reliance water columns. Of particular interest are the Westinghouse stokers. These are of the new multiple retort type with integral steam turbine and gear box. This turbine, with its wide speed range is exceptionally suitable to the minimum and maximum loads encountered in the Vienna plant. The clinker grinder is driven from the same turbine. The stokers embody an improved type of secondary ram and adjusting mechanism which allows the stroke to be varied in small increments, thus minimizing the attention required for adjustment of the stoker. Each stoker is fitted with a coal feed indicator which registers the rate of feed in thousands of pounds per hour.

FIG. 5. ALL PUMPS AND DRAFT AUXILIARIES ARE INSTALLED IN THE BASEMENT

The furnaces are provided with Bailey water cooled bridge walls. The air preheaters are the Combustion Engineering Corp. plate type, and the breechings were built by Connery and Co., Inc. Plibrico plastic furnace lining was used over the Bailey wall, this being of particular value in installing a lining around the numerous vertical inclined tubes and drums which are a feature of the Bigelow-Hornsby boiler.

Instruments and Gages

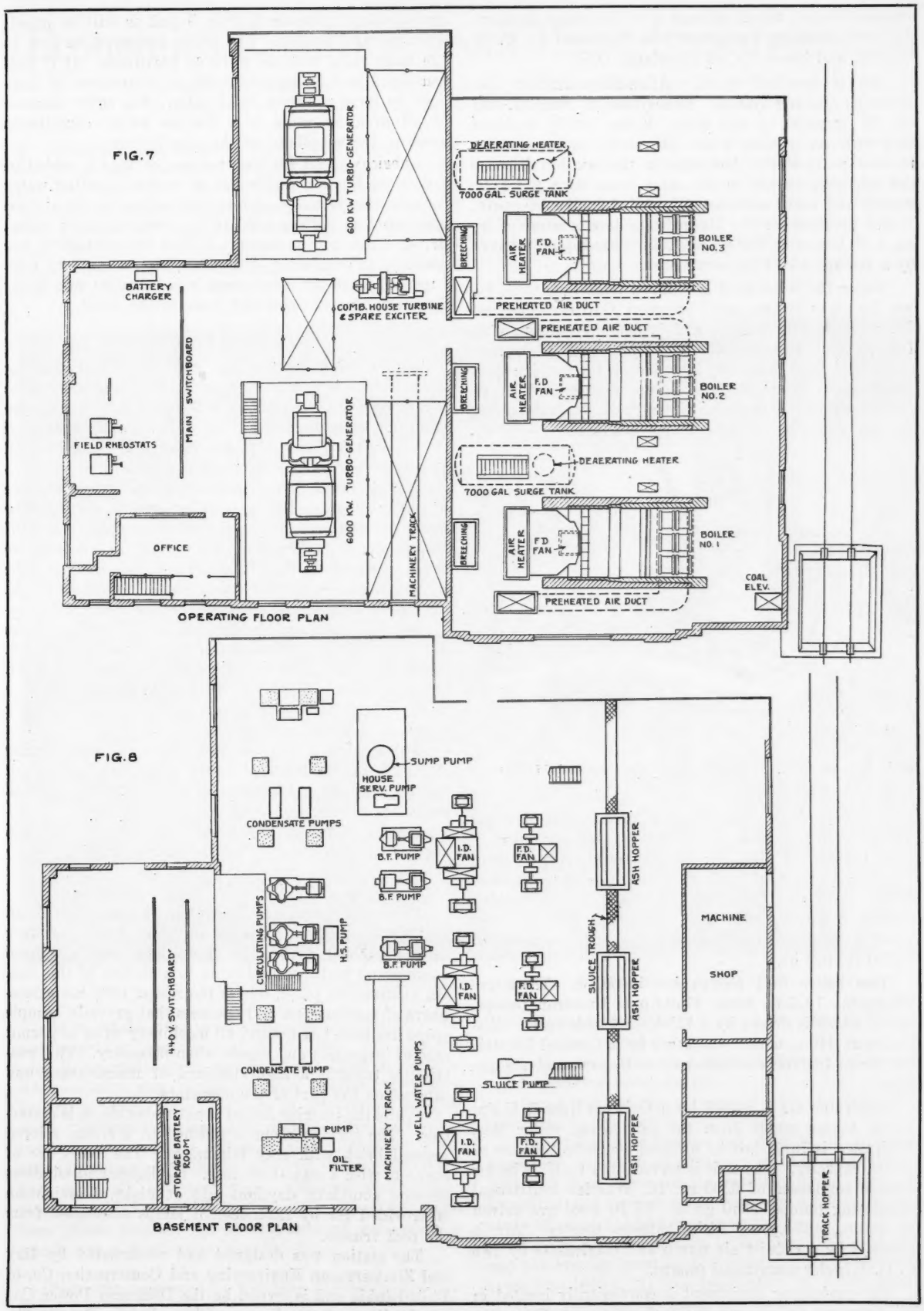
Instruments for determining boiler operation are mounted on a boiler control panel placed directly in front of the boilers. This panel contains the following instruments: 2 Hays multi-point draft gages, reading wind box pressure, furnace pressure, boiler exit pressure, and draft pressure in air preheater; 1 Foxboro steam and feedwater pressure recorder; 1 Leeds and Northrup 10-point temperature recorder for recording flue gas, air, water, steam, and blow-down line-temperatures; 2 Bailey boiler meters, measuring air and steam flow; 2 Bailey flow meters measuring feedwater to the boilers; and 8 remote control push buttons for controlling the forced and induced draft fans.

A Bailey flow meter is also installed in the main steam line to the turbine. Operators in the boiler room are always kept informed as to the electrical load on the main generators by means of a large Charles Cory & Sons load indicator actuated from the recording wattmeter on the switchboard, mounted at one end of the firing aisle.

Coal Delivered by Barge

Coal is delivered to the plant by barge, ordinarily, although railroad facilities are also provided. When delivered by barge, it is removed by a locomotive crane provided with a clam shell bucket and dumped into a track hopper, to which railroad cars also deliver. Here it falls into a double roll 28 by 28 Bartlett & Snow crusher which delivers directly to a vertical steel bucket elevator which elevates it to the upper part of the boiler house where it is transferred to a flight conveyor. The latter is installed above the overhead coal bunker into which the coal is distributed. The conveyor and bucket elevator are driven by Allis-Chalmers induction motors, through Cleveland Worm and Gear Co. 40-1 speed reducers. From the overhead bunkers, the coal is withdrawn by an electric larry fitted with a Standard

FIG. 6. THE FAN ROOM, SHOWING INDUCED DRAFT FAN AT RIGHT



FIGS. 7-8. PLANS OF OPERATING FLOOR AND BASEMENT LEVEL

automatic scale, which delivers it to the stoker hoppers. All coal handling equipment was furnished by C. O. Bartlett and Snow Co. of Cleveland, Ohio.

Ash is handled by the Allen-Sherman-Hoff Co. Hydrojet sluicing system. This system is compact, and can be operated by one man. Being totally enclosed and with no moving parts, it results in no dust, a feature particularly desirable in this station because the ash hoppers are in the same room with the fans, pumps and other auxiliaries installed in the basement. Water pressure for the Hydrojet system is supplied by an A. S. Cameron, 700-g.p.m., 265-ft. head, pump driven by a 100-hp. Allis-Chalmers motor.

Water for boiler feed is pumped from four wells below the plant by two motor-operated, Gardner Governor Co. reciprocating pumps, and is delivered through an International pressure filter into an overhead storage tank. A "Liquidometer" installed on the turbine gage board shows the water level in the storage tank at all times. From the tank the water flows by gravity into the hot well where it mixes with condensate.

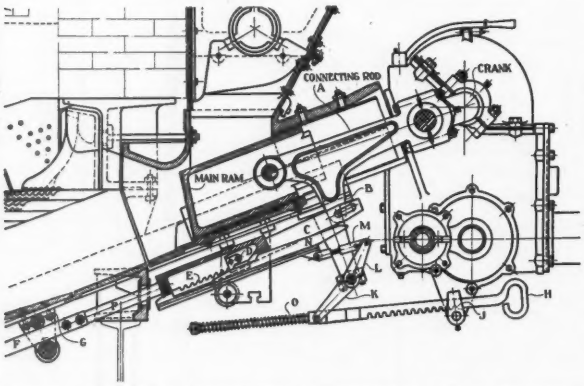


FIG. 9. STROKE ADJUSTING MECHANISM OF WESTINGHOUSE STOKER

Water for boiler feed is taken from the hot well and sent through radojet inter and after cooler, low pressure bleed heater to a direct contact deaerating heater, after which, the boiler feed pumps force it into the boilers. Steam bled from either of two points on the turbine heats the feedwater to about 220 deg. F. The feed water heaters are Cochrane make with a capacity of 85,000 lb. per hr.

Two boiler feed pumps are installed. These are 300-g.p.m., 1025-ft. head, 1750-r.p.m. Cameron pumps, one of which is driven by a 125-hp. variable speed Allis-Chalmers 440-v. motor; the other by a General Electric Co. steam turbine controlled by a Hagan master regulator.

Generator air is cooled by a Griscom-Russell U-Fin cooler, taking water from the condensing water line. Excitation is furnished by a direct-connected exciter of 50 kw. capacity. The unit is served by a C. H. Wheeler surface condenser of 6200 sq. ft., Wheeler centrifugal circulating pumps, 9350 g.p.m., 15 ft. head are driven by 60-hp., 495-r.p.m., Allis-Chalmers motors. Air is removed by a radojet air pump and condensate by two C. H. Wheeler centrifugal pumps.

All condensing equipment is conveniently located in the basement underneath the turbine room. The exact arrangement is shown in Fig. 8 and as will be noted, is simple and orderly. The whole basement, in fact, is one large room with no walls or partitions. It is well ventilated and is supplied with an abundance of daylight by large windows on all sides. The entire absence of all dividing walls is a feature which contributes much to the simplicity of the pipe layout.

Lubricating oil for the turbine bearings is cooled in a Griscom-Russell Multiwhirl oil cooler. Cooling water for this unit as well as for general service in the station is supplied by a 350-g.p.m., 165-ft. head, Cameron pump, driven by a 25-hp. motor. Elliott twin strainers are installed in connection with these pumps. A 7 by 6-in. Ingersoll-Rand air compressor is installed to supply air for cleaning and operating tools in the plant.

Electrical Features

Low voltage current for emergency and starting house service is furnished by a 180-kw. General Electric 440-v. generator, driven by a 255-kw., 325-lb. pressure non-condensing turbine. This unit also has connected to the shaft a 75-kw., d.c. generator which can be used as a spare exciter for the main generators.

The electrical layout, because of the entire absence of high voltage switching in the station, is simple. The main switchboard, a 17-panel steel vertical board of Westinghouse construction, is located in the turbine room, as shown in Fig. 7. All 440-v. switching is done by means of remote controlled, solenoid operated I.T.E. air circuit breakers installed in the basement. The generator field rheostats are located on the turbine room floor behind the switchboard and are motor operated. A view of the main switchboard is shown in Fig. 1. Current for operating the switches is obtained from a storage battery in the basement which is kept by a 2.5-kw. motor generator set.

Motors are all roller bearing across the line starting type, 25 hp. and above being fed from air circuit breakers on 440-v. switchboard and controlled by push buttons at convenient points.

Generator voltage is controlled by a Brown Boveri regulator acting directly on the exciter field.

Conclusion

From the foregoing description, it will be evident that the designers have spared no effort in incorporating in the Vienna station the latest and most approved engineering features applicable to a station of this size. On visiting the plant, one is impressed with the atmosphere of spaciousness and neatness that prevails. Ample space has been left around all machinery so as to permit ease of inspection and repair when necessary. This contributes towards a high standard of maintenance and interest on the part of the operators.

While the interior design is not elaborate, it is attractive. The turbine room is finished in a cream colored pressed brick with grey trimmings. The floors are of concrete with a smooth surface. Skylights and windows provide abundant daylight and at night, illumination is provided for by incandescent lamps suspended from the roof trusses.

The station was designed and constructed by Day and Zimmermann Engineering and Construction Co. of Philadelphia and is owned by the Delmarva Power Co., a subsidiary of the Eastern Shore Public Service Co.

Economies Resulting from Plant Improvements

TENNESSEE EASTMAN CORP. MADE SAVING OF $2247 A MONTH BY CHANGING HEATING PROCESS AND GENERATING OWN POWER. BY ARTHUR M. MILLER*

LOCATED in Kingsport, Tenn., is the plant of the Tennessee Eastman Corp., a subsidiary to the Eastman Kodak Co. It is a wood carbonization plant and manufactures chemically pure methanol, acetate of lime, creosote and flotation oils, hardwood pitch, charcoal, (Tec-Char) for casehardening purposes and for poultry foods, charcoal (Tec-Lump) for fuel and charcoal briquettes (Charkets).

Late in the year 1924, it was found necessary for various reasons to change the process in one of the Tennessee Eastman Corp. plant departments; namely, that of carbonization. This change did the following four things for the betterment of the plant:

1. It increased the yield of products.
2. By eliminating rather involved mechanical equipment, it decreased maintenance cost.

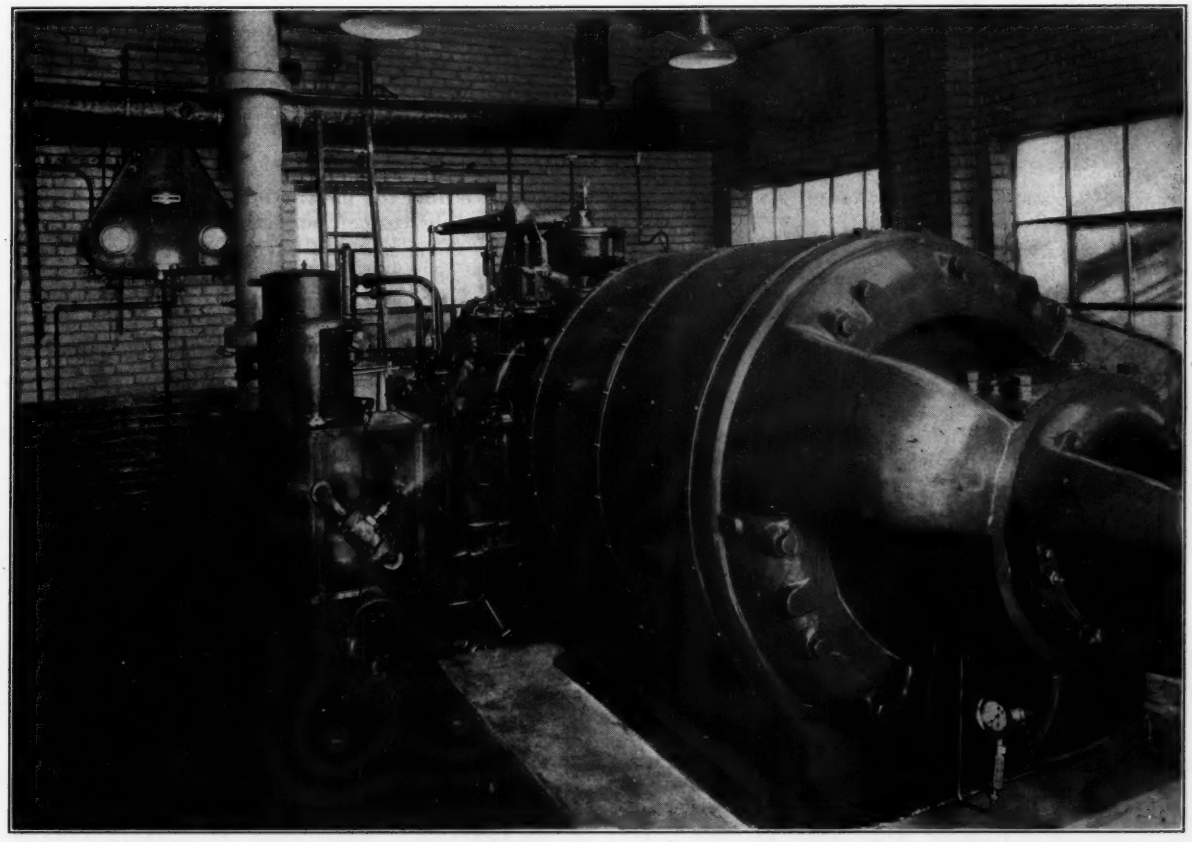


FIG. 1. NONCONDENSING TURBINE GENERATING UNIT IN TENNESSEE EASTMAN CORP. PLANT

As a whole, the wood carbonization industry has not been very prosperous since the war. For this reason, it has been quite necessary for those companies, who wished to stay in this business, to bend every effort to manufacture their products at the lowest possible costs. It was not alone a question of the amount of profit to be made but rather a case of whether or not any individual plant could survive. Economies, therefore, were all important and a program which would make possible savings in operation, in some cases might have made possible the continuance of an operation which was not otherwise feasible.

3. It made possible the use of less labor and fewer skilled operators.
4. Due to process conditions, it decreased steam and electrical consumption.

Item 4 was not the paramount issue, nevertheless it could not be overlooked.

This change-over process indicated in the preceding paragraph came in the months of May and June of 1925. A comparison of the months in the same year preceding and succeeding this change will give an idea of its effect on the power situation.

For the first five months in the year 1925 (old process) the average monthly fuel consumption by the boiler house was 1649 t. It took practically the entire months of June and July to make the change-over. For the

*Past chief engineer of the Tennessee Eastman Corporation; now associated with the General Chemical Company, Marcus Hook, Del.

remaining five months in the year 1925 (new process) the average monthly fuel used by the boilers amounted to only 1336 t. per month. The saving in coal, alone, therefore, averaged about 313 t. per month.

Under the old scheme of operation, a large amount of tar was produced which could not be used advantageously except as fuel. For the first five months in 1925, actually 49 per cent of the total heat units were furnished by this tar. For the last five months in 1925 (new process) practically no tar was available for fuel as it had been broken down chemically into more valuable and salable products. By elimination of this tar burning, the boiler house operation was improved appreciably as the tar was very difficult to handle successfully.

During the year 1925, all of the electric power for this plant was purchased. During the five-month period of operation under the old process, the average monthly electrical cost was actually $1015.00 higher than it was during the last five months of the year when the plant was operating on the new process.

By changing over, therefore, from the continuous (old) to the discontinuous (new) process, power cost was affected advantageously in three ways. It saved 313 t. of coal per month. It eliminated tar as a fuel and broke it down chemically into much more valuable salable products. It saved about $1015.00 per month in purchased electric current.

In the middle of the year 1925, it was evident that the new process in other respects was much better than the old one and that expenditures could safely be made for improvements. Studies were therefore made immediately, to determine what additional saving could be made.

Simple Distillation Replaced by Multiple Effect Evaporators

Up to this time all of the pyroligneous acid, which is the raw liquor produced by condensing the vapors given off when wood is carbonized in closed retorts, was distilled by simple distillation which is merely vaporizing the liquor by introducing a steam coil containing high-pressure steam. It was obvious that a great saving could be made by substituting for this type of distillation a multiple effect evaporator and it happens that in this case, a triple effect unit was chosen. Theoretically, such an evaporator is 2.7 times as efficient for distillation as is the simple type of still which was originally used. The evaporator was put into service in January, 1926, and it developed that it actually saved about 16 per cent of the total plant steam production.

It is possible to operate such an evaporator on steam pressure below 10 lb. gage, whereas in the case of the old simple stills, it was necessary to furnish steam with a pressure of at least 100 lb. gage. In addition to the evaporator, there were two other plant departments using low-pressure steam. One, the methanol refining plant and the other, the department containing the acetate drying units. As soon as the evaporator was put into operation, it was evident that the new gross consumption of low-pressure steam would justify the installation of a turbine generator. The turbine would then supply exhaust steam for this process work and the electrical energy generated would be delivered to the plant.

Generating Unit Installed to Supply Power and Low-Pressure Steam

In June, 1926, a 500-kw., 480-v., 3-phase, 60-cycle alternating current generator was installed complete with the proper switchboard equipment to connect it with the existing plant electric distribution panels.

To drive this generator, a non-condensing impulse type of turbine was selected, as it seemed particularly well adapted for the service. It was designed to operate on 115 deg. gage steam pressure and against a back pressure of between zero and 10 lb. gage. The turbine was direct connected to the generator, making a compact unit, up-to-date in all respects. This turbine generator was furnished complete by the General Electric Co.

For the ten months before the generator went into service, the total period during which the plant had operated on the new process, the average monthly cost of purchased electric power was $2219. For the five months succeeding the installation of the generator, the average monthly cost of purchased electric power was only $1396. The monthly saving, therefore, was approximately $823. To be sure, it was necessary to furnish slightly more steam for the operation of the turbine but this was not an appreciable item as was evidenced by comparison of the relative coal consumptions. The average monthly coal consumption during the year 1925, prior to the time of turbine installation, was only 86 t. less than the average monthly consumption for the four months in the same year succeeding the turbine installation. Furthermore, this small additional amount of coal was not entirely chargeable to the turbine, for during this period, a few additional steam consuming units were installed.

As is evident from the foregoing, electric power was purchased over and above the amount which it was possible for the generator to produce while the turbine was supplying the exhaust steam requirement of the plant. The generator up to this time, however, was operating separately from the utilities. It was supplying electrical energy to certain plant departments while the utilities supplied the others.

This was not a satisfactory arrangement, as at times it was necessary to waste steam and at other times to put live steam through a reducing valve to make up the quantity of low-pressure steam required. This was due to the fact that the total plant exhaust steam consumption and the electrical power requirements for the departments supplied by the generator, did not furnish a balanced load for the turbine generator. The situation was complicated furthermore by the fact that the ratio between steam and power requirements differed in the daytime from that at night. Then too, Sunday and holiday conditions offered still another variation.

As there was small hope of installing in the future, additional units which would use exhaust steam in the proper quantities to balance the operation, it was obvious that it would be necessary always to purchase some current from the utilities and to manufacture only that portion of electrical energy which could economically be made in supplying the plant with process steam.

The only alternative would have been to operate a condensing plant in competition with the utilities.

Parallel Operation with Central Station

For this reason, it was decided to install the additional equipment required to parallel the plant generator with the generators operating at the utilities' central station. This would make it possible to manufacture at all times all the current which could be generated by the amount of steam used in process work. The balance of electrical energy could then be conveniently supplied by the utilities. This scheme would then eliminate waste of steam as well as the necessity of bleeding live steam into low-pressure lines.

This paralleling equipment was installed in October, 1926. For the first three weeks after it was in operation it saved the purchase of power which would have cost $460 on a monthly basis.

At the end of this period, a new still was installed known as a continuous lime lee, for use in concentrating acetate liquor. This affected the turbine operation and so eliminated further checking up on the saving made by the paralleling device.

This lime-lee still made possible the consumption of an additional amount of low-pressure steam for evaporating purposes, replacing thereby high-pressure steam previously used. It actually went into service on December 20, 1926, and from that date to January 4, 1927 (a test period) it made possible an increase in power generation representing a saving of about $349 per month.

Of course, both in the case of the paralleling equipment and of the lime-lee still, the total savings mentioned are really gross, as it would be necessary in determining net savings to deduct the cost of the additional steam required to replace the loss of heat units caused by putting the steam through the turbine. As stated in discussing the installation of the turbine itself, however, this item is inappreciable.

Firemen Put on Bonus System

During this whole development period, opportunities to improve boiler house operation were not overlooked. Conditions were changed, better methods were evolved, and economies obtained which were startling. Among other things, a very unique system of bonus wage payment for the firemen was instituted. This scheme has been successful and has unquestionably lowered the steam cost.

The savings discussed have been made possible by:

1. A change in manufacturing process.
2. The installation of different types of steam consuming units to accomplish the same end.
3. The installation of a turbine generator.
4. Incorporation of additional appurtenances on turbine and generator.
5. Improvements in the boiler plant.

Every plant cannot take advantage of the first saving listed which was made possible by a change in manufacturing process. Most plants, however, could be investigated with a view of endeavoring to make some of the savings shown in the balance of the list. To be sure, it would be possible in the case of some operations to make considerably greater savings; while on the other hand, there are some plants where savings could not be made anywhere near as great.

It happens, in this case, that the change in manufacturing process did not afford sufficient saving in power cost alone to justify the change but the saving which it entailed, together with the other improvements afforded by the new process, as compared with the old, would indicate that the expenditure was justified.

Total investment for the evaporator, the continuous lime-lee still, the turbine generator complete with its paralleling equipment, did not exceed $80,000. As a saving of about $2247 per month actually resulted from the installation of this particular group of items, it is obvious that the development program was worth while.

Other Changes Contemplated

It is known, at the Tennessee Eastman plant, that there are still steps to be taken to obtain further economies. New exhaust steam consuming units can be developed and more power generated as a result. Immediate consideration is being given to the advisability of raising the temperature of the boiler feedwater by using turbine exhaust steam in a closed heater. Calculations reveal that this will increase boiler capacity and make possible at the same time, at a slight cost, the generation of more electrical energy. New projects at the plant will eventually require additional boiler capacity. A new boiler plant already tentatively designed will supply considerably higher pressure steam than is now possible; such a plant would be modern and in all probability would decrease the average cost of producing steam. The turbine was so designed that it would operate on higher pressure steam and superheat (if such conditions were available later) merely by a change in nozzles. With new boilers, and better steam conditions, the water rate on the turbine would be less and the efficiency greater. This would mean lower cost per kilowatt-hour for the electrical energy.

FIG. 2. STEAM INLET END OF TURBINE

Despite the progress which this plant has made, particularly with reference to decreasing power costs during the past 2 yr., work of investigating the possibility of further improvement is continually in progress. It is only with methods such as these that the industrial plant of today can meet competition or even under present conditions maintain existence.

Mill Types Affect Fineness of Pulverized Coal

REPORT PRESENTED AT SECOND NATIONAL FUELS MEETING SHOWS THAT VARIOUS PRINCIPLES OF MILL ACTION MAKE FUELS OF DIFFERENT FINENESS. BY LINCOLN T. WORK*

RECENT DEVELOPMENTS in the field of pulverized coal have given new emphasis to fineness as an important factor in combustion. The manner in which fineness of fuel plays a part in combustion, its bearing upon operation, the range of particle size commercially

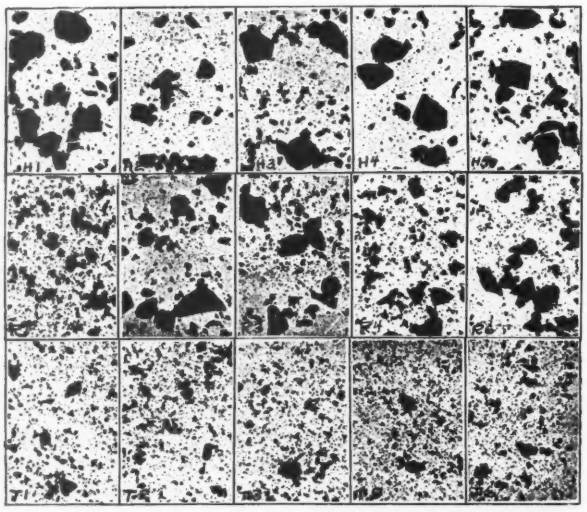


FIG. 1. PHOTOMICROGRAPHS OF PULVERIZED COAL SAMPLES FROM THREE TYPES OF MILLS, H, R AND T INDICATING SAMPLES FROM HAMMER, ROLLER AND TUBE MILLS RESPECTIVELY

obtained and the manner in which the mill types meet the demands for fineness comprise the scope of this investigation.

With the exception of two demonstration roller mills, no effort was made to select one plant in preference to another, nor was the effort made to establish special conditions in the plant. In cases where it was not possible to secure samples, observations were made as to the conditions of grinding and combustion.

It must be understood that no single mill could safely be used as a basis for comparison. In spite of the fact that individual installations varied with conditions of design or operation, there could be observed from the overall effect of several the differences between the three types, hammer mills, roller mills and tube mills.

It is natural in considering pulverization of coal that fineness should be of paramount importance; but there is a real question as to what is the proper fineness for suitable combustion and greatest operating economy. On that point, the problems in the small plant and in the large plant are somewhat different.

SMALL PLANT OPERATION DEMANDS FINER COAL

With the larger units, e.g., those having 5000 cu. ft. or more of combustion volume, there usually is sufficient distance for the flame to travel 20 ft. or more before striking a surface. Particles of relatively large size can be completely burned in that distance. In addition, combustion is accelerated by the use of radiant refractory and the boiler surfaces are kept well away from the flame or protected by a thin layer of refractory. This keeps the combustion chamber hot and makes possible the use of relatively slow-burning fuel.

It is not surprising that in such installations the significant fineness is considered to be the percentage coarser than the 60- or 100-mesh. Particles larger than this maximum for a given set of conditions are objectionable for these reasons: they impinge on the walls while still hot, causing erosion or slag formation; they drop into the ashpit and are cooled before being burned out, resulting in carbon loss in the ash; they serve as a nucleus about which carbon monoxide may be formed, and they pass out of the stack as smoke.

Application of pulverized coal to the smaller units presents somewhat different problems. Save in the case of specially designed settings, the dimensions are small and the path or length of flame travel is restricted.

*Chemical Engineering Department, Columbia University. From a paper presented before the Second National Fuels Meeting of the A. S. M. E.

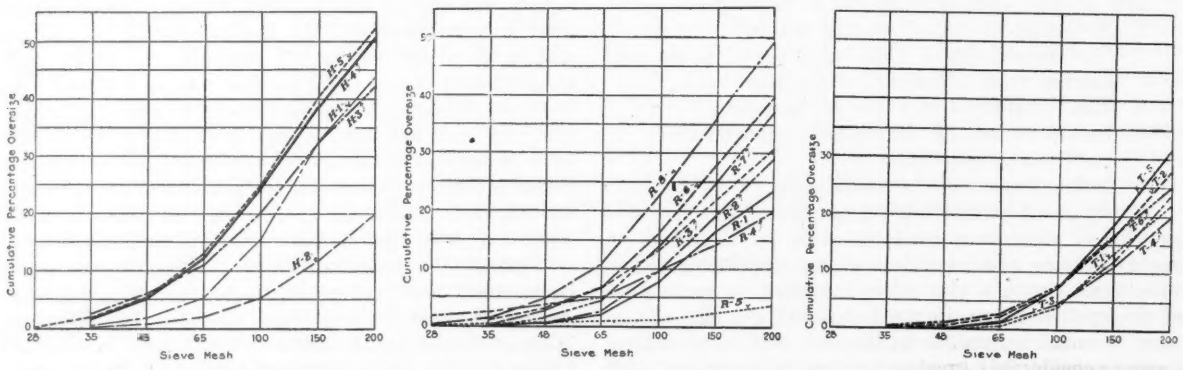


FIG. 2. GRAPHICAL REPRESENTATION OF THE CUMULATIVE PERCENTAGE OVERSIZE OF THE SAMPLE SHOWN IN FIG. 1

The furnace walls are occasionally air-cooled but more frequently are solid refractory. They cannot safely be heated to incandescence. The boiler surfaces are close to the flame, often within 3 ft.

As far as fineness is concerned, a fuel 80 per cent or more finer than 200 mesh permits material shortening of the flame, as the coarse particles which take time to burn are lacking. But the superfine particles, which may be considered those less than 1/5 or 1/10 of 200 mesh, when well mixed with air, make the reaction approach more nearly that of true gases and make the flame self-sustaining. Such a flame has greater solid radiating surface within it and heat may be transferred rapidly from it to the boiler surface.

While the more exacting requirements of high heat release have been necessary in the smaller units there are trends toward greater water-cooling of the combustion chamber and toward smaller boilers and settings at higher steam pressures. It becomes a matter of economics whether the increased cost of securing the fineness for higher heat release will be compensated for by savings in reduced setting cost and the lesser cost of the building to house the power plant.

Superfines Decreases Flame Length

Thus it is evident that fineness is important, not only with respect to sieve sizes but also with respect to that impalpable power called superfines which is an essential factor in rapid combustion. Along with turbulence, it has made possible the use of pulverized coal in marine boilers. It is also of importance when this form of fuel is burned in any furnace of small volume or of short flame travel. There is indication that finer fuel will affect the future design of large installations.

Commercial machines for pulverizing coal to the required fineness may be classified according to the nature of the crushing action into three main types: the hammer mill, the roller mill and the tube mill. Although the operation and design of individual units may vary, it is to be expected that mills of each type will show distinct fineness characteristics.

In Fig. 1, photomicrographs of typical samples from each of the three types of mills are shown, Fig. 2 is a graphical representation of the screen analysis from the several samples of each type of mill, while Fig. 3 shows the fineness and distribution of the superfines, or material through the 200-mesh screen, of two typical samples, the upper one from a hammer mill and the lower one from a tube mill. One micron is equal to 0.001 mm. and 100 microns correspond roughly to 200 mesh.

Conclusions

Observations of the author confirm the view that fineness of pulverized fuel is important both with respect to sieve sizes and with respect to the amount of superfines. Slagging and erosion of the walls, carbon loss in the ash, carbon monoxide in the stack gases, and dark smoke result from coal which is too coarse for a given setting. The flame from coal containing superfines is self-sustaining against rapid heat removal, is shorter, smoother, more uniform in texture, simpler to start and easier to maintain than one from coarse coal. By making for high heat release in the flame, the dual requirement of sieve mesh and superfines should affect the design of future large installations.

There are variations in the pulverizing actions of different types of mills which usually show themselves in the resulting fineness of the fuel. The high-speed hammer mill normally acts on the coarse feed to produce more particles of sieve size and less superfines. Such a fineness curve is likely to result in large variations in sieve mesh with air circulation, with mill load and with mill wear.

The roller mill is more positive in its elimination of coarse particles and usually produces a lower percentage of sieve sizes than the hammer mills. For a given sieve reduction, it usually gives less superfines than the tube mill. The tube mill produces the finest coal. It acts upon both large and small particles, giving a large amount of superfines and a low percentage of sieve

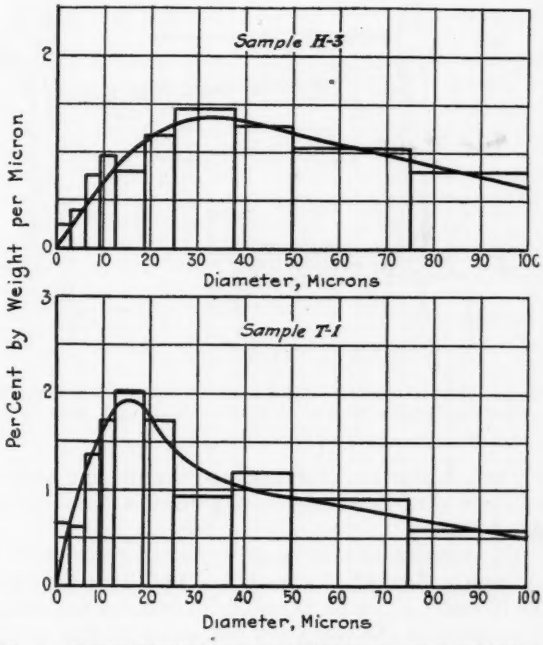


FIG. 3. DISTRIBUTION OF FINENESS OF THE MINUS 200 MESH MATERIAL

sizes. Air sweeping supplements the normal mill action to eliminate coarse particles from the final product.

Classifiers for separating coarse particles from the product and returning them to the mill for further grinding differ greatly in their effectiveness. This is a phase of the milling to which attention should be paid to secure material improvement in fineness and mill economy.

In this study, which is limited to fineness and pulverizing equipment, it must be remembered that other factors such as, cost of installation, overall operating cost, furnace design and operation, premixing of air and fuel, the use of preheated air, and turbulence in the flame are also important.

The Iowa Railway and Light Corp. has completed the tie-in with its main transmission lines, connecting the Boone, Iowa, unit with the Cedar Rapids and Marshalltown circuits, over a 33,000-v. transmission line. The new hook-up gives all communities in the Boone district the benefit of this hook-up through the Roland substation which has recently been finished.

Selection of Stokers at Greenwood

ANALYSIS OF CONDITIONS SURROUNDING PLANT AND STATEMENT OF RESULTING ECONOMIES. BY ROY STOTT*

SINCE the purchase of the power plant by the City of Greenwood, Miss., in 1904, the load has steadily increased. In order to keep pace with this growth, the city has been forced constantly to improve and enlarge the plant. At the time the plant was acquired, the installed capacity was only 90 kw. This has been increased until today the rated capacity of the plant is

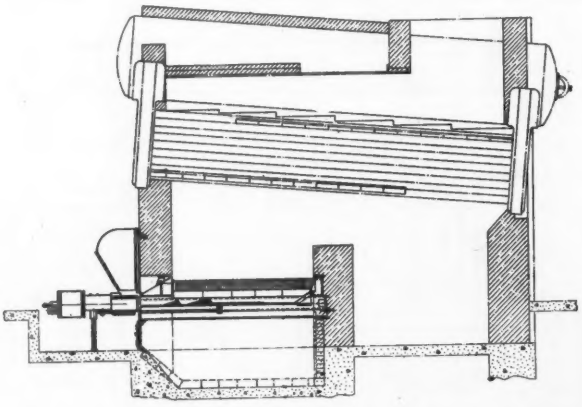


FIG. 1. SECTION THROUGH BOILER AND STOKER SHOWS HOW COMBUSTION SPACE WAS INCREASED BY LOWERING ASHPIT FLOOR

5000 kw., a 2500-kw. Westinghouse turbine and surface condenser with auxiliaries having been installed in the fall of 1926.

This increase in load made strenuous demands upon the firing equipment. In the fall of 1925, it was realized that it would either be necessary to increase the steaming capacity or else carry two boilers on the line during the peak loads. If two boilers were carried, it would have been necessary to reduce the steam pressure to 200 lb. and during the cleaning periods of the two newer boilers it would have been necessary still further to reduce the steam pressure as the third boiler would stand only 180 lb. pressure. This would materially effect the economy of the turbines and it was therefore decided to equip two of the existing boilers with stokers and carry the load on one boiler.

One of the main reasons for the decision to install stokers was to eliminate the emission of dense smoke and soot from the stacks. Due to the smoky characteristics of both the Alabama and Western Kentucky coals and the low boiler settings, it was impossible to operate the existing hand fired equipment without smoke. The residents in the vicinity of the plant were continually complaining of the soot deposit and it was necessary to insist upon smokeless operation from any type of equipment before it would be considered.

Another reason for the decision to install stokers was because the desired increase in capacity could be obtained with a smaller investment and a greater saving in fuel. If a new boiler with hand fired grates had been installed, the desired increase in capacity could have been obtained but the fuel economy would not have been effected. Due to the fluctuating load on the station, the addition of mechanical stokers to the old boilers offered a more flexible arrangement than could be obtained with hand-fired boilers.

*Manager, Greenwood Electric Light and Power Plant.

FACTORS DETERMINING TYPE OF STOKER

From an engineering standpoint, four important points were considered in the selection of the type of stoker installed. These points were: smokeless operation, kind of coal to be burned, ratings to be obtained and local facilities for handling the refuse.

The question of smokeless operation offered a real problem. Due to the limited furnace volume, the underfeed stoker was considered better adapted for smokeless operation than any other type of stoker or pulverized

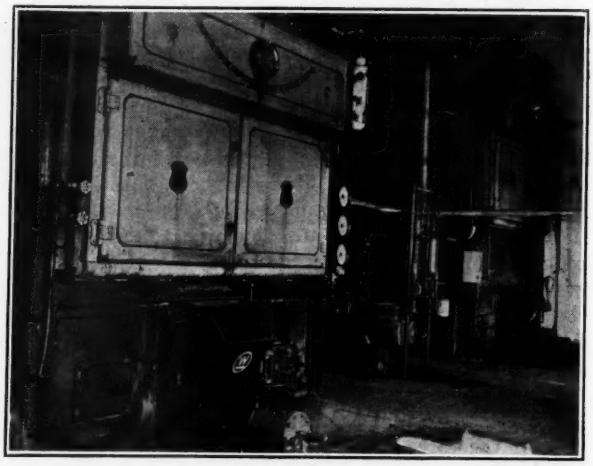


FIG. 2. VIEW DOWN FIRING AISLE OF GREENWOOD PLANT

fuel equipment. With the underfeed stoker, the green coal is admitted below the burning fuel bed. The gases that are distilled off must pass up through the burning fuel bed where they are heated to the ignition temperature and mixed with the necessary amount of air to complete combustion. This air for the combustion of the gases is supplied from the wind box through ducts which admit the air over the fuel bed. By having horizontally baffled boilers and setting the stokers 2 ft. below the floor line to obtain a larger furnace volume, the smoke problem was solved.

Most of the coal burned comes from the Alabama field and is a coking coal, requiring considerable agitation of the fuel bed to keep it broken up in order that the air may penetrate it uniformly. Western Kentucky coal is also obtained in Greenwood at a favorable price and there are times when it is advantageous to burn this fuel. It is more free burning than the Alabama coal and burns better with less agitation of the fuel

bed. The ash from the Western Kentucky coal fuses at a much lower temperature than the ash from the Alabama coal and if not properly handled will give considerable trouble due to clinkers. A proximate analysis of a representative sample of each of the two grades of coal is given below:

	Alabama	W. Kentucky
Fixed Carbon	53.2	45.0
Volatile Matter	32.4	33.0
Ash	9.2	13.0
Moisture	5.2	9.0
Sulphur (Separately Determined)	0.2	4.0
Fusing Temperature of Ash	2600 deg. F.	1900 deg. F.
B.t.u. as Fired	13,500	11,500

Ratings to be obtained demanded a forced draft type of stoker, but the necessity of being able to remove the ash from the front of the stoker and at the floor level eliminated all forced draft types except the single retort underfeed. The necessary ratings could have been obtained with pulverized fuel firing, but with the limited furnace volume this kind of equipment could not be considered.

Features of Stokers

As the only type of stoker that apparently could meet all the above requirements was the single retort underfeed type, this was selected by the city. The stoker installation consists of two single retort Westinghouse underfeed stokers installed under two 488-hp. Heine boilers. Both stokers were set 2 ft. below the level of the boiler room floor in order to increase the setting height as much as possible and thereby increase the furnace volume. Figure 1 shows the stoker setting drawing and Fig. 2 shows the stokers installed. The boilers were originally set very low, one being only 5 ft. from the bottom of the front header to the boiler room floor while the other was 8 ft. The boiler with the low setting operates only as a spare, as it can be operated at only 200 lb. pressure while the other boiler operates at 250 lb. pressure. For this reason, it was felt that the expense of raising the boiler to obtain a higher setting would not be justified.

Air is supplied to the stoker wind boxes by two Buffalo Forge forced draft fans, one motor driven and one turbine driven. The fans discharge air into a duct running under the floor in front of the boilers and either fan may be used to supply air to either stoker. The amount of air supplied to the stoker wind boxes is governed by an automatic step compensated regulator, controlling the supply of air in accordance with the variation in steam pressure.

Extremely fluctuating loads are common at Greenwood. A large part of the power load comes from the cotton gins and results in a heavy pull for a short time and then a sudden dropping off. A typical load curve during the cotton ginning season and during the off peak season is shown in Fig. 3.

Operating Results Compared

Comparing results obtained in 1925 the last year under which the plant was operated entirely with the hand-fired equipment, with those obtained in 1927 will give the best idea of the saving effected by the stokers. During the year 1925 there was generated 3,835,246 kw-hr. and a total of 6330 t. of coal was burned representing a coal rate of 3.30 lb. of coal per kw-hr. In 1927 a total of 7771 t. of coal was burned in generating 5,913,770 kw-hr., representing a coal rate of 2.63 lb. of coal per kw-hr. This saving of 0.67 lb. of coal per kw-hr., however, cannot all be credited to the stokers. Some of it is due to the new turbine installed in 1926. The water rate of the new turbine at the average load carried is approximately 90.5 per cent of the water rate of the old machine and this machine was in service almost 80 per cent of the time during the year. If the new turbine had not been in service, the coal rate on the station would have been 2.85 lb. of coal per kw-hr. which would represent a saving of 0.45 lb. of coal per kw-hr. over 1925.

Credit should be given to the stokers for being able

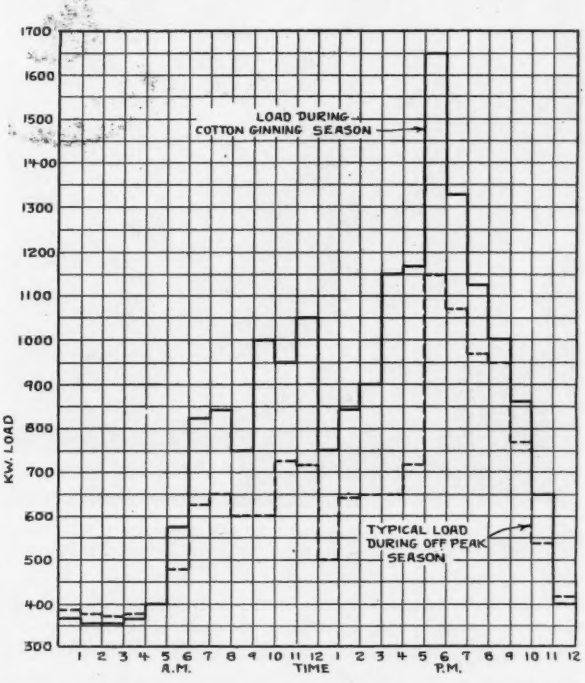


FIG. 3. TYPICAL LOAD CURVES ON GREENWOOD PLANT

to carry the increased load on one boiler, which would not have been possible with the hand-fired equipment. With the hand-fired equipment, it would have been necessary to carry two boilers on the line during the peak loads. This would mean carrying two boilers on the line for 6 hr. each day and banking for 18 hr. over a period of four months during the year. Assuming that it would take 100 lb. of coal per hour to maintain a banked boiler, the coal used per year for banking this additional boiler would be about 86 t., or, at $4.29 per ton, it would amount to $369.

Due to the small size of the plant, only a small saving was made in labor. With only one boiler in service, one man would be required in either case but the amount of work required by the firemen at present is much less than when the boilers were hand-fired.

From records of the plant it has been calculated that the annual savings effected by the stokers amount to over 25 per cent of the investment of $13,000.

Aerial Photography in the Power Plant Industry

SUCCESSFUL APPLICATION TO PRELIMINARY SURVEYS OF POWER PLANT SITES AND TRANSMISSION LINE LOCATION MARKS THIS BRANCH OF ENGINEERING AS A VALUABLE AID TO THE INDUSTRY

AERIAL PHOTOGRAPHY, during the past few years has been gaining favor among engineers in all industries. This is particularly true in the power plant industry where its application for transmission line location is an established fact, each year seeing an increased number of companies utilizing this new method of mapping. It has been used to a somewhat more limited extent for preliminary studies of hydraulic and steam power plant sites.

FIG 1. AERIAL VIEW IN MOUNTAIN DISTRICT IN WEST VIRGINIA, SHOWING GENERAL TOPOGRAPHIC FEATURES

For this aerial service, a number of cameras have been developed. As a rule, they take a picture about 6.5 by 8.5 in., each exposure overlapping the succeeding one by 50 or 60 per cent. For transmission line work, it is customary to have the aeroplane follow a predetermined line of flight as shown in Fig. 2A. Due to the prevalence of cross winds, the center line of the photographs obtained usually deviates considerably from the desired line of flight as indicated in Fig. 2B.

Maps for transmission line work are often taken at a scale of 1 in. = 800 or 1 in. = 1000 ft. and at the latter scale the photograph will take in a strip from 8000 to 9000 ft. wide, depending on the size of the plate used. Due to the effect of winds, as mentioned before, it is impossible to have the center lines of the photograph correspond with the designated line of flight at all times, so it is customary to guarantee a much narrower strip, one company placing this limit as 2500 ft. on each side of the designated line. Sometimes it is not possible to determine the best location within the limits given. In this case, two or three strips may be taken as shown in Fig. 2A. These strips are also overlapped about 50 per cent.

This overlap, known as side lap or endlap, is advisable to facilitate matching the finished, or, mosaic map and to make possible the use of the stereoscope. Each section is taken four or five times and the leeway afforded is of great assistance in eliminating defective or distorted exposures due to uneven country, tilting of the camera, small clouds or shadows and irregularities of flight and alinement.

MAP AS SMALL AS 1 IN. EQUAL 2000 FT. ARE POSSIBLE

Practically any desired scale map can be constructed, Fig. 3 representing actual photographs taken for transmission line location, the scale ranging from 1 in. = 200 ft. at the top, Fig. 3A, to 1 in. = 1000 ft. at the bottom, Fig. 3E. Figure 3C, scale 1 in. = 600 ft., is unusually interesting, as it is a section of the Beardstown-New Haven survey made for the Kentucky Utilities Co. and shows at the right-hand side the original of the famous song, "My Old Kentucky Home," near Beardstown, Ky.

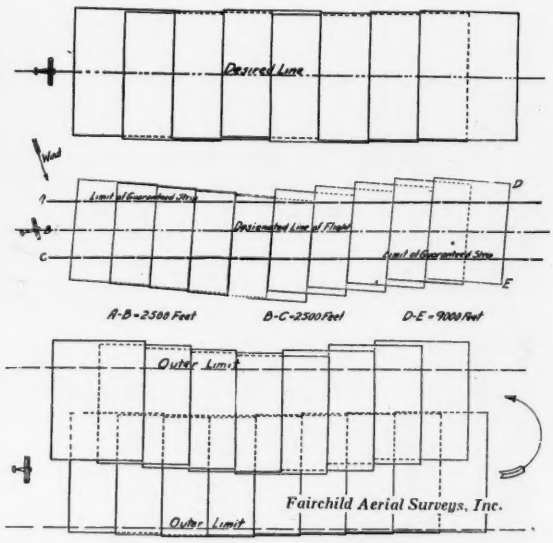


FIG. 2. AN AERIAL SURVEY CONSISTS OF MANY OVERLAPPING SMALL PICTURES TAKEN ALONG A DESIGNATED LINE OF FLIGHT

Sometimes maps are made on scales of 1 in. = 2000 ft. or smaller. Under good conditions, these small scale negatives can be enlarged up to four diameters, the increased area covered by small scale pictures decreasing the cost somewhat, although, of course, at the expense of detail.

Pictures at any scale may be utilized directly, as, for instance, in a stereoscope for closely studying details and relief of the country, they may be matched together to form an aerial photographic or mosaic map or they may serve as the basis of a preliminary survey in the preparation of an aerial line map or regular topographic map.

In making a mosaic map, the individual photographs are brought to a common scale and matched up to form

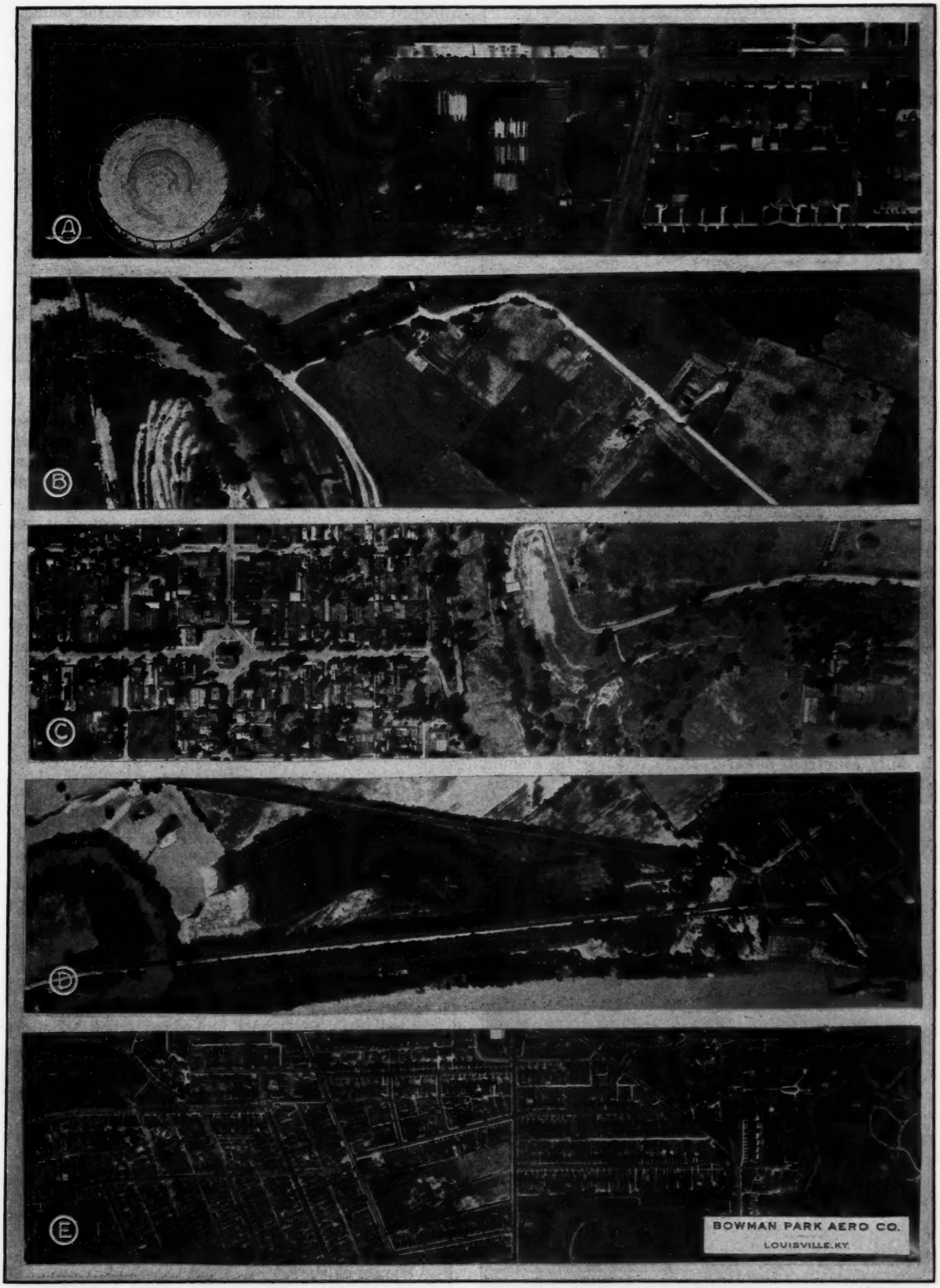


FIG. 3. BY FLYING AT DIFFERENT HEIGHTS PHOTOGRAPHS CAN BE OBTAINED AT ANY DESIRED SCALE. FIG. 3A IS 200 FT. PER INCH. FIG. 3B IS 400 FT. PER INCH. FIG. 3C IS 600 FT. PER INCH. FIG. 3D IS 800 FT. PER INCH AND FIG. 3E IS 1000 FT. PER INCH

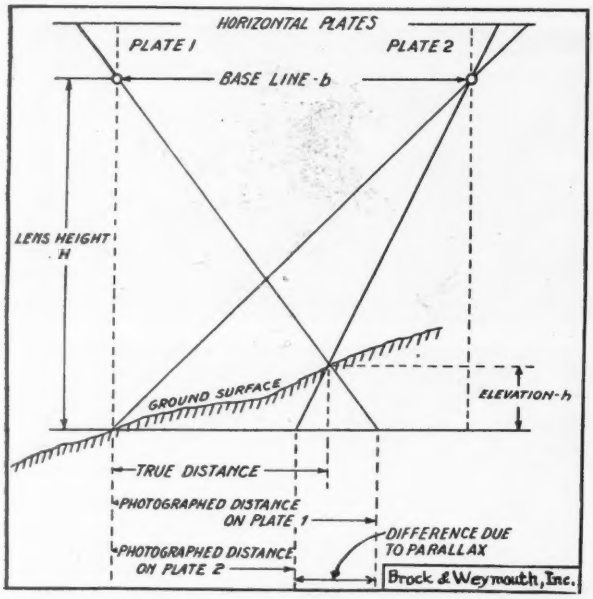


FIG. 4. DIAGRAM ILLUSTRATING THE EFFECT OF UNEVEN GROUND IN CAUSING DISTORTION AND DISPLACEMENT IN A FLAT HORIZONTAL PRINT

a continuous picture, the matching, where possible, being done along fences, rivers or other natural divisions so that the break between the pictures is not noticeable.

Uneven Country Causes Some Distortion on a Flat Plate

Such a map mounted on heavy board or cloth is a detailed map of the country and in flat or slightly rolling country can be made with a high degree of accuracy. In hilly countries, however, there is a certain amount of distortion due to perspective. This effect is illustrated in Fig. 4. In the exposure, Plate 1, the point A would be misplaced outward the distance y, while in Plate 2, the same point would be displaced inward the distance x. This difference due to parallax is, however, utilized in the stereoscope and forms the basis of a method of drawing contours on the photographs.

The stereoscope is an instrument, usually built without lenses, to bring, by means of a double reflection of mirrors, two photographs in juxtaposition. To use it, photographs must overlap at least 50 per cent, giving, for every point on the ground, a photograph taken from two positions, as for instance plate 1 and plate 2 of Fig. 4. When properly placed, the left eye sees the point A from the position of plate 1 and the right eye from the position of plate 2, the combination making the area viewed appear in relief. If the pictures be reversed, ridges appear as valleys, valleys as ridges while buildings, poles and similar objects appear as holes in the ground.

In Europe, especially, a great deal has been done in developing method, measurements and optical processes for producing contour maps direct from the photographs. This work calls for more or less ground work to furnish reference points and planes, a good triangulation system being the best.

To produce aerial maps as accurate as transit and plane table maps requires equipment of the same precision. There are also a number of variable factors which must be considered, among them the difficulty of maintaining a constant altitude for long periods and unevenness in the ground surface. With a 10-in. focal length camera flying at 6100 ft., the 100-ft. contour would have a scale of 600 ft. to the inch while the 200 and 300-ft. contours would have scales of 590 and 580 respectively.

Some Groundwork Necessary to Make a True Scale Map

Contours determined by the Brock method and etched on the photographic plate are shown in Fig. 5. Elevation differences of a few fixed points are used as reference points. The determinations can be carried

FIG. 5. SECTION OF A CONTOURED MOSAIC. CONTOURS ARE ETCHED ON THE NEGATIVE

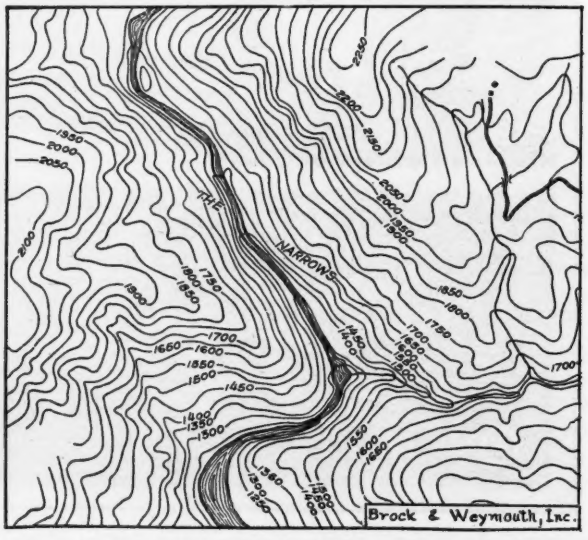


FIG. 6. SECTION OF A TRUE SCALE TOPOGRAPHIC MAP MADE FROM AERIAL SURVEY FOR POWER PURPOSES

FIG. 7. HOW A POWER TRANSMISSION LINE IS PROJECTED ON AN AERIAL PHOTOGRAPHIC MAP

through a series of overlapping plates but to avoid the possibility of small cumulative errors, it is customary to secure check elevations on each separate plane. This calls for a stadia survey or line of levels over the ground area. Figure 6 is part of a completed true scale map with a final uniform scale of 600 ft. to the inch. In this connection, photographs are only a means to an end and the mosaic map is a by-product.

A more common method of determining contours is to use the photographs, either to the same scale or enlarged, in a connection with a plane table or stadia survey. Operations are facilitated by having all details and locations on the map. Contour lines and other features are inked in on the photographs. They are then sent to the office to be used direct or to be transferred to tracing cloth.

In Fig. 7, the ease with which property lines can be determined and the transmission line projected on a photographic map is shown. The necessity of avoiding the high priced land in parcels Nos. 44 and 45 is shown by the northward swing of the line. A southward swing was impractical because of the new real estate development indicated by the cement sidewalks.

Some of the advantages of aerial photography can be summed up briefly as: time savings over long lines or through rugged country; cost reduction due to shorter lines with fewer angles; ability to avoid wooded areas; possibility of taking advantage of present roads and trails for maintenance and construction and savings in purchasing right-of-way privileges.

Secrecy in conducting the survey helps in keeping down the last mentioned costs because, until the agent visits the land owner with the contract, nothing is known of the pending development and there is no opportunity to raise prices. Again the owner can be shown on the photograph exactly where the line is going and is not later dissatisfied because of his inability to read a map and discover too late that the line is going through his orchard or between the house and barn.

Reduced Clearing Cost May Pay for Entire Survey

In many sections of the country, the reduced costs of clearing the right-of-way is a considerable item. In a recent survey made in New York State, the engineers estimated that the survey saved 50 per cent of the cost of the right-of-way and more than paid for itself by avoiding areas which would have necessitated excessive clearing of timber and underbrush. This survey cost about $50 a square mile. To a large extent, the value of a survey depends upon the coöperation, ability and experience of the surveyors, draftsmen and engineers who must use it. One of the interesting features of this new development is that it does not displace any of the old survey and location methods but is complementary to them, enabling the field men to work rapidly and to the point.

Costs will vary with a number of different items but will usually run between $50 and $150 a mile. A single machine can photograph from 50 to 80 mi. a day, the number of days that are suitable for photographic work depending upon the weather and climatic conditions. Generally the cost is based on a contract for the entire job and not on an acre or mile basis, the total cost or estimate depending upon the scale, length and width of survey, number of angles in proposed line, facilities for aeroplane landing fields and the degree of accuracy required.

Total production of soft coal during the week ended October 6, according to a report from the Department of Commerce, Bureau of Mines, including lignite and coal coked at the mines, is estimated at 11,028,000 net tons. Compared with the total output in the preceding week, this is a decrease of 28,000 t. or 0.3 per cent. Production during the week in 1927 corresponding with that of October 6 amounted to 10,286,000 t.

Total production of bituminous coal during the calendar year to October 6 (approximately 237 working days) amounts to 364,002,000 net tons. For the corresponding period in 1927, the total amounted to 403,157,000 net tons.

Production of anthracite continues to increase. The total production during the week ending October 6 is estimated at 1,938,000 net tons, an increase of 86,000 t. or 4.6 per cent over the output in the preceding week. Production during the week in 1927 corresponding with that of October 6 amounted to 1,597,000 t. Total production of anthracite for the calendar year to October 6 is 61,867,000 t.

Oil Engine Power Reduces Ice Making Costs

ICE COST REDUCED 73 PER CENT IN STERLING, ILL. PLANT BY SUBSTITUTING OIL ENGINE FOR PURCHASED POWER

ALTHOUGH THE POWER rate for electricity was low, the high minimum demand cost was so high that the Sterling Ice & Produce Co. decided to change from purchased power and install an oil engine as

FIG. 1. AMPLE SPACE AND CONVENIENCE PERMITS EASY CHANGE FROM PURCHASED POWER TO INDIVIDUAL POWER AT STERLING (ILL.) PLANT

motive power for their refrigerating machines and electric generators.

HIGH DEMAND CHARGE RAISES COST OF POWER

Electric power rates had been reduced to 1 1/3 cents per kw-hr. but the demand cost of $400 a month imposed on this plant due to the number of machines installed became prohibitive because of the long periods during which one or another of the machines was not being operated or in which they were operated much below capacity.

Installation of a 160-hp. Buckeye twin-cylinder, two-cycle, single-acting, solid injection, semi-Diesel oil engine was decided upon. In order to provide flexibility of operation, the engine was belt connected to the 30-t., ice-making capacity, Vilter ice machine through a clutch which engaged the pulley that drives the belt. It is also belted to a 50-kw., 3-phase, 60-cycle Westinghouse generator which furnishes electric current for driving auxiliary machinery. A small Vilter ice machine of 15-t. ice capacity, belted to a 25-hp. General Electric Co. motor, is used for peak loads during the summer.

TEMPERATURE INDICATION SERVES AS GUIDE

Provision was made for operation without necessity of constant supervision. With this in mind, the engine is provided with Moto Meter Co. industrial thermometers to indicate the temperature of the discharge cooling water from the cylinder and cylinder head jackets, two being attached to each cylinder. Faulty operation quickly registers itself in rise in temperature of the cooling water at one or more points. Excessive temperature results in setting off an alarm that notifies the engineer who may be attending to duties in other parts of the plant. The temperature indicator is of gage form and is fastened to the engine at convenient points, the temperature changes being conveyed through capillary tubing to the Bourdon springs in the indicator which are filled with a special liquid that is uniformly responsive to temperature changes throughout the entire range of instrument.

Since starting the engine on April 1 of this year, it has been running on a 24-hr. schedule and in that time has not been shut down more than 4 hr. The only replacement made since beginning operation was one bearing. The fuel oil used is of a thick black variety having a gravity of 18 to 20 deg. Baumé and costing 75 cents a barrel or about 1½ cents a gal. The freight charge amounts to about 2 cents a gallon. Lubricating oil used costs 52 cents a gallon and about 45 gal. is used daily.

OPERATION COST REDUCED 73 PER CENT

In July, on a consumption of 7400 gal. of fuel oil, 740 t. of ice was produced, making the cost $0.382 per ton, considering only fuel and lubricating costs, compared with a former cost of $1.40 when current was purchased. In making the change to oil engine motive power, no additional attendance cost was incurred. No

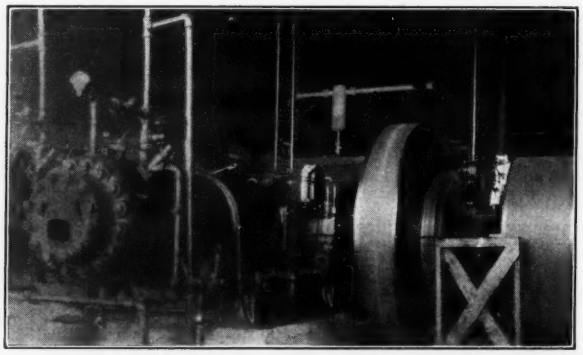
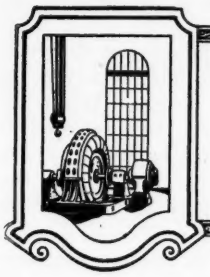


FIG. 2. BUCKEYE SEMI-DIESEL ENGINE IS BELTED THROUGH CLUTCHES TO ICE MACHINES AND ALSO DRIVES GENERATOR FOR LIGHTING AND ELECTRIC POWER

consideration was given, in the above cost comparison, to capital charges because the initial cost of the engine will soon be wiped out by the lower power cost. Besides the manufacture of ice, this plant furnishes cold storage refrigeration during July and August for which about $100 a month is received.

Cooling water is obtained from a drilled well 1208 ft. deep. An oil filter located just above the fuel oil pumps is equipped with a very fine screen which not only prevents foreign matter but also water from passing into the cylinders.

A MOVE to coöperate with the government in directing aviators at night is reported from Colorado, according to Transactions of the Illuminating Engineering Society. The smokestack of the Pueblo Plant of the Southern Colorado Power Co. is 250 ft. high and 14 ft. in diameter at the base. The stack is to be lighted by eight 500-w. flood lamps placed in pairs at the base of the stack. When lighted, they will cause the stack to appear as a huge illuminated cylinder.



ELECTRICAL MACHINERY FOR LIGHT AND POWER

Electricity---What It Is and How It Acts*

PART XIII. FORCES ACTING ON A MOVING CHARGE. ENERGY STORAGE IN ELECTRIC AND MAGNETIC FIELDS. THEORY OF THE SOLENOID

IT WAS A kind streak in Nature that induced her so to arrange things that the movement of an electric charge gives rise to the production of a magnetic field, for it is probable that 99 per cent of all electrical apparatus depends for its operation upon the existence and action of this magnetic field. Every electric generator, every motor and transformer, every electric bell, all electrical communication systems in some way or other utilize magnetic fields produced by moving charges.

We have shown, in the preceding article, that the movement of an electric charge and its electrostatic field results in the production of an electromagnetic strain, the magnitude of which is proportional to the value of the moving charge, its speed and the shape of its path. We have shown also, in earlier articles, that what we recognize as an electric current is in reality a stream of moving electrons or ions. Knowing these two things, it would be natural to expect that an electric current would be surrounded by a magnetic field, the magnitude of which would depend upon the intensity of the current. This, as every reader, no doubt, knows, is true—every electric current has associated with it a magnetic field the strength of which is proportional to the strength of the current.

FORCES INVOLVED IN THE MOTION OF A CHARGE

Before we consider the magnetic effect of the electric current as a whole, it will be interesting to investigate more closely the forces involved during the time that an electric charge is in motion. What, for instance, is the effect of the electric or magnetic field upon the electron itself? Is there any reaction of the field upon the charge and if so what is its nature?

It has been demonstrated that when a charge is set in motion, the electrostatic field is distorted; the equipotential spheres assuming eccentric positions with respect to the charge. Thus, in Fig. 1, the equipotential rings surrounding the charge e, when at rest, are concentric as shown at A but are displaced as shown at B when the charge is set in motion towards the left. The amount of eccentricity is dependent upon the speed of the charge as can be seen from the equation,

$$\frac{d}{r} = \frac{s}{V}$$

where d is the distance between the charge and the center of the equipotential sphere considered, r, the radius of the sphere; s, the speed of the charge, and V, the velocity at which the effect of motion of the charge is transmitted to distant points of the field.[1] From this it is

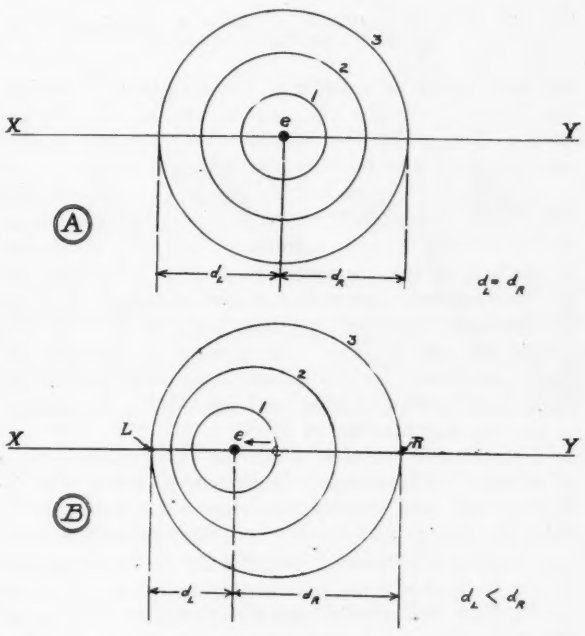


FIG. 1. ILLUSTRATING THE MANNER IN WHICH MOTION OF A CHARGE PRODUCES AN UNEQUAL DISTRIBUTION OF POTENTIAL GRADIENT

At A are shown three equipotential rings surrounding a charge e at rest. At B is pictured the same charge after it has been set in motion toward the left. The equipotential rings are eccentric, making the distance d_L from the charge to point L shorter than the distance d_R from the charge to point R. Since both of these points are at the same potential, it is obvious that the potential gradient must be steeper ahead of the moving charge than it is behind it.

evident that the amount of distortion is directly proportional to the speed of the charge.

Because of this distortion of the field around a moving charge, the potential gradient ahead of the moving charge is greater than it is behind it. This is evident if we refer to Fig. 1B. A point L on the equipotential ring 3 where it crosses the line XY to the left of the charge e is closer to the charge e than another point R

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[1] Ordinarily, this speed, where the field is in air, is the speed of light or 186,000 mi. per sec.

diametrically opposite and to the right of e. Yet these two points are at the same potential, for they are both on the same equipotential circle, hence, the potential gradient is steeper to the left of e than it is to the right. Due to this unequal distribution of potential gradient around the charge, a force is exerted by the field upon the charge in such a direction as to tend to move the charge toward the center of the equipotential spheres. This force, therefore, is opposite to the motion of the charge and its magnitude is proportional to the speed of the charge—the greater the speed, the greater the opposing force.

Electromotive Force and Counter Electromotive Force

Thus, the motion of the electron and the consequent distortion of the electrostatic field require the continuous application of a force in the direction of motion, this force, producing the motion we call the electromotive force while the reactive force exerted by the field is called the counter electromotive force.

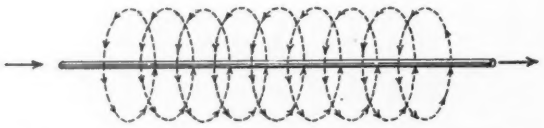


FIG. 2. MAGNETIC FIELD AROUND A STRAIGHT CONDUCTOR CARRYING CURRENT

As long as the speed of the electron or other charge is constant, these two forces will remain in equilibrium. If any attempt is made, however, to speed up the charge by increasing the electromotive force, the eccentricity of the field will increase and the unbalance between the potential gradient in front and in back of the charge will also increase. An increase in electromotive force, therefore, results in an immediate increase of counter electromotive force and the effect is a tendency to prevent any increase in speed.

In a similar manner, when the electromotive force is reduced the counter electromotive force will be greater than the electromotive force and will tend to drive the charge backwards. A backward motion, however, would immediately bring about a force opposed to the force producing that motion and this new force would tend to keep the charge moving in its original direction.

Effect Is Similar to That of Inertia in Mechanics

Thus it is seen that the distortion of the field around a moving electron tends to prevent any change in motion of the charge. The effect is similar to the effect of inertia in mechanics except that in the case of the electric charge, the apparent mass varies with its velocity. When the charge is at rest, its apparent mass is zero. As the speed increases, the mass increases and at the speed of light, theoretically its mass would become infinite. Of course, as has been shown by Einstein, a charge could never move at the speed of light, so the possibility of infinite mass of an electron becomes merely an interesting speculation. That the mass increases as the speed increases has been demonstrated by the action of the electron in the vacuum tube. At the high velocities attained by the electron in certain vacuum tube experiments, the mass of the electron increases appreciably.

The reaction of the field upon the moving charge is due to the magnetic field, which we have seen was, in turn, the result of motion of the charge. When the charge is traveling at a uniform speed, the force applied to it (electromotive force) is exactly balanced by the reactive force (counter electromotive force) and the resultant force is zero. Since there is no force acting on the charge, there is no acceleration.

When the charge was first set in motion, however, there existed no reactive force. The driving force in setting the charge in motion and by creating the magnetic field, accomplished a certain amount of work, in doing which a certain amount of energy was expended. When the driving force is exactly counterbalanced by the reactive force, no further work is done.

Energy Is Stored in Magnetic Field

The energy expended in thus setting the charge in motion and in the creation of a magnetic field is stored up in the magnetic field itself where it exists as potential energy. In setting the charge in motion, a certain amount of the electrostatic energy of the charge is transformed into an equivalent amount of electromagnetic energy, this transformation requiring a certain amount of work on the part of the driving force. This transformation, once established and having exhausted the energy of the source supplying the driving force, the conditions remain as they are; that is, the charge remains in motion at a constant speed.

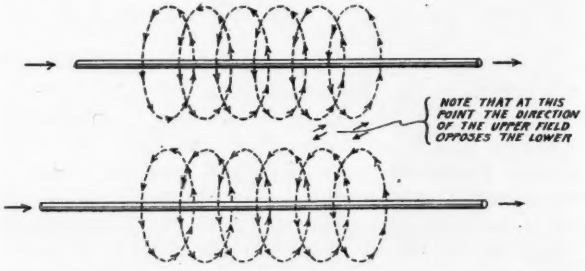


FIG. 3. MAGNETIC FIELDS ABOUT TWO WIDELY SEPARATED STRAIGHT CONDUCTORS CARRYING CURRENTS IN THE SAME DIRECTION

When the motion of the charge is to be stopped, it is evident that a force must be applied in a direction opposite to the direction of the driving force. An amount of energy must be applied, exactly equal in amount but opposite in direction to that which was expended in establishing the motion of the charge. This force is available in the magnetic field and comes into play the instant the driving force is removed or reduced. In other words, the removal of the driving force (electromotive force) is accompanied by the disappearance of the electromagnetic energy and its restoration in the electrostatic field of the charge.

Thus it is apparent that although the creation of the magnetic field when a charge is set in motion requires the expenditure of a certain amount of energy, this energy is returned to the charge or rather to the electrostatic field of the charge, when the motion is stopped. The total amount of energy stored in the two fields (the electrostatic and electromagnetic) at any

instant is constant. A transformation from one of these fields to the other occurs when an electric charge is stopped or started, each transformation creating a force opposed to that causing the transformation and requiring the expenditure of a certain amount of energy on the part of the force causing the transformation.

This interchange of energy between the electrostatic and the electromagnetic fields is of great importance in electrical engineering, particularly in the case of resonance phenomena in power factor control and radio work.

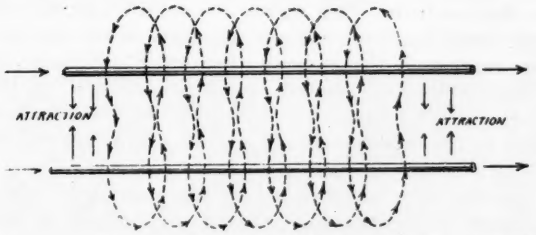


FIG. 4. WHEN TWO CONDUCTORS CARRY CURRENT IN THE SAME DIRECTION THE LINES OF MAGNETIC FLUX WILL ASSUME THE FORM SHOWN HERE

In this case the loops of force make one complete circuit around both of the wires instead of passing around them individually as in Fig. 3. This is due to the fact that at the point between the wires where the respective fields tend to touch, the direction of the loops oppose each other; hence they pass from one to the other as shown. Under these conditions the conductors are attracted to each other.

Magnetic Field Around a Conductor Carrying Current

Since an electric current is in reality a number of electrons in motion, it must be evident to anyone that a current carrying conductor is surrounded by a magnetic field as pictured in Fig. 2. The wire serves very much as a pipe through which the electrons flow. Suppose now that we place two wires carrying streams of electrons in the same direction, parallel to each other as shown in Fig. 3. Since the currents are in the same direction, the direction of the magnetic fields will be in the same direction. At the point where the two sets of magnetic loops tend to touch, it will be noted that the directions of the magnetic fields oppose each other; hence, instead of each loop passing around its own wire, they find it more convenient to jump to the adjacent loop so that each loop of magnetic field makes a complete path around the two wires as shown in Fig. 4. Under these conditions, because of the tendency of the magnetic loops to shrink like stretched rubber bands, the two conductors are drawn together. In other words, parallel streams of electrons flowing in the same direction, attract.

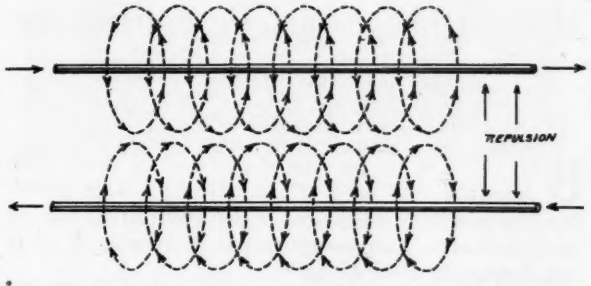


FIG. 5. FIELDS SURROUNDING TWO CONDUCTORS CARRYING CURRENTS IN OPPOSITE DIRECTIONS REPEL EACH OTHER

Let us now assume the two conductors to be carrying streams of electrons flowing in opposite directions. In this case, the lines or loops of force about them are swirling in the same direction and there will be no tendency for the two sets of loops to merge. Instead, they will repel each other as shown in Fig. 5. Thus, parallel streams of electrons flowing in opposite directions repel each other.

That these two assertions are correct can easily be proved by the arrangement shown in Fig. 6. Here two light aluminum rods are freely suspended so that their lower ends are just immersed in a shallow tray of mercury; they are therefore free to move under the slightest force which may be applied to them. Suppose now that an electric circuit is so arranged, first, so as to cause the rods to carry currents in the same direction as shown in Fig. 6A and second so as to cause them to carry currents in opposite directions as in 6B. In the first case, the lower ends of the rods will be drawn together, due to the attractive influence of the magnetic fields surrounding them, while in the second case they will be forced apart because of the repulsive force.

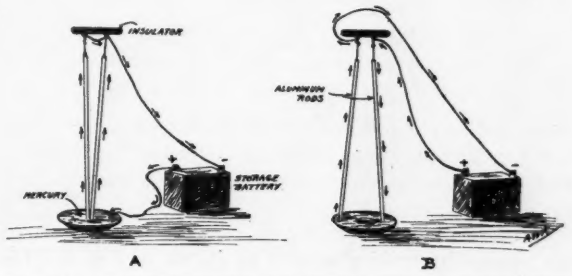


FIG. 6. AN EXPERIMENT TO SHOW THE CORRECTNESS OF THE THEORY OF REPULSION AND ATTRACTION BETWEEN CURRENTS FLOWING IN THE SAME AND IN OPPOSITE DIRECTIONS

In the experiment two aluminum rods are suspended so that their ends are just immersed in a bath of mercury. When currents are passed through the rods in the same direction the rods are attracted as at A, while, when the currents flow in opposite directions as at B, they are repelled.

Field Surrounding a Conducting Loop

Anybody having had anything to do with electrical devices of any type is familiar with the fact that all electrical equipment is provided with coils of wire in various forms. Wherever a magnetic field is present, there will be found a coil or helix of some sort. Why is this? We have just learned that a current carrying conductor is surrounded by a magnetic field. In what manner then, is a coil associated with such a field? These questions we will now endeavor to answer.

By means of Fig. 5, we demonstrated how the magnetic fields surrounding two parallel conductors carrying currents in opposite directions repelled each other. Suppose, however, instead of having two separate conductors, each supplied from a different source, we merely bend the upper wire back upon itself. Brief consideration will make evident that with this latter arrangement, in so far as the magnetic fields are concerned, the effect will be the same as that produced by

Fig. 5. Suppose further that instead of merely bending the wire back on itself it is bent in a complete circle as shown in Fig. 7. Because the current on one side of the loop is flowing in the opposite direction from that on the opposite side all the magnetic lines will enter the loop at one face and leave at the other.

With such an arrangement, due to the combined action of all the magnetic lines of force concentrated at the center of the loop, a very much more powerful field

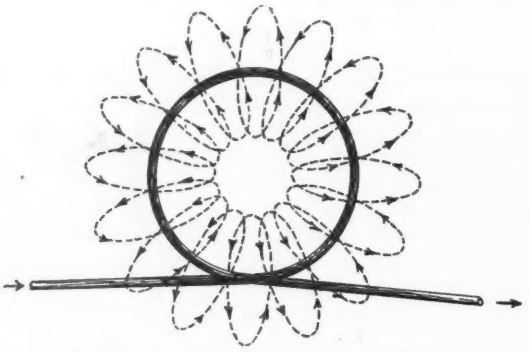


FIG. 7. MAGNETIC FIELD AROUND A LOOPED CONDUCTOR
All of the lines of force enter the loop at one face and leave at the other.

is set up than is possible by a straight conductor. This is the great advantage of the coil over the straight wire and is the reason coils are used in all electromagnetic devices.

Instead of one turn or loop of wire, let us continue the process by making a helix as shown in Fig. 8. The effect is obvious, from a study of the diagram. A large number of the lines of force produced by each turn

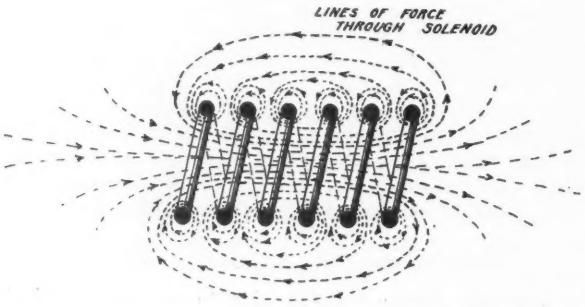


FIG. 8. SHOWING THE INCREASE IN FLUX RESULTING FROM WINDING THE CONDUCTOR IN THE FORM OF A HELIX OR SOLENOID

will encircle the entire helix, producing a very strong field at the center of the coil.

If the turns are brought still closer together as in Fig. 9, a still larger number of lines of force will be concentrated at the center, resulting in a still stronger field.

This, briefly, is the principle upon which the solenoid or electromagnet operates. The strength of the magnetic field at the center of the coil, is directly proportional to the number of turns in the coil, and to the strength of the current flowing through them. It is for this reason that in the design of all electromagnetic equipment the "ampere turn" is used. The ampere turn is a unit representing the ability to produce a certain magnetic intensity. In other words, the number of lines of force produced by a given helix is always proportional to two factors: first, the current in amperes flowing in the helix; second, the number of turns of the helix.

In making use of the term ampere, here, we do so merely because this term is so generally known to be the practical unit of current. It would be more consistent for us, in attacking the problems of electrical engineering by means of the electron, if we used the electron-turn. This, however, would be an exceedingly small unit to use in practice, since an ampere represents the passage through a conductor of 6,300,000,000,000,000,000, electrons per second. So the ampere turn represents the magnetic field which is produced by the above number of electrons traveling around one turn of wire in one second.

Having shown in this article the manner in which the shape of a conductor carrying current governs the

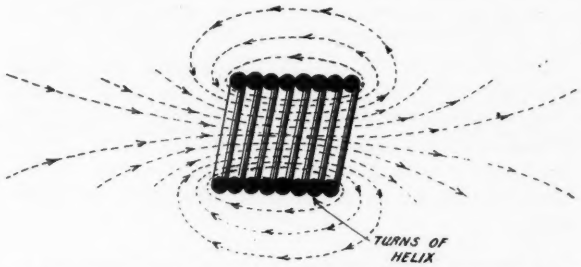


FIG. 9. BRINGING THE TURNS CLOSER TOGETHER, AS SHOWN IN THIS DIAGRAM, RESULTS IN A STILL FURTHER INCREASE IN FLUX

intensity of magnetic field produced, we are now ready to consider further aspects of the production of magnetic fields. One of the most important of these, inductance, will be discussed in the next article.

Maintaining High Power Factor in an Industrial Plant

By F. A. Westbrook

BECAUSE of its growing importance in power rate schedules, the need of maintaining a high power factor is receiving wider and wider recognition and in many first class plants some means of keeping it up is now frequently to be found.

At Newark, N. J., The Hay Foundry & Iron Works has recently completed the installation of some new equipment in connection with which very practical measures have been taken to correct the plant power factor. The work was done by MacNutt, Watts & Tankard, electrical engineers and contractors, New York City.

Power is brought into the plant from the street pole line at 4150 v., 3-phase, 60-cycle; it is used for the larger motors at this voltage.

Figure 1 shows the high tension switchboard and oil circuit breakers, all placed alone in a fireproof vault. The three wires of the 3-phase circuit from the pole line terminates on manually operated disconnect switches separated from each other by insulating parti-

tions. The current then passes through automatic oil circuit breakers equipped with overload relays beyond which the Public Service metering equipment is located. The high tension circuits to the motors are in three-conductor, rubber-insulated and lead covered cables in conduit, laid in the concrete floor of the engine room. These are controlled by the oil circuit breaker located in the switchboard. There are also two 150-kw. transformers which step down the 4150-v. current to 220 and 440 v. for lighting and the smaller individual constant speed drive motors in the machine shops. These are controlled by the oil circuit breaker at the right of Fig. 1 and in the center of Fig. 2. By it power may be shut off from the transformer without interfering with the feeders serving the high tension motors. Similarly, the latter may be shut down by the other oil circuit breaker without interfering with the motors and lights served from the transformer.

Two synchronous motors using 4150-v. current drive machines which run continuously, so that their corrective effect on the power factor is continuously available. One of these motors is 250-hp. and is direct connected to an Ingersoll-Rand air compressor. The compressed air is used to operate pneumatic tools of various kinds such as drills, reamers and so forth, as well as shop hoists. The other 4150-v. synchronous motor is a 450-hp. unit and drives a 220-v. direct-connected, direct-current generator of 350-kw. capacity. The direct current thus generated is used to drive the variable speed machine tool motors.

Both of these synchronous motors are provided with automatic starters placed by themselves in an individual fireproof vault, which is shown at the right of Fig. 2. The faces of the control panels are dead front with remote control. One of them is shown at the right of Fig. 3. It will thus be seen that all high tension equipment except the motors themselves is in fireproof vaults which are kept locked and thus insure safety of operation. Furthermore, all equipment associated with high tension apparatus is carefully grounded. This includes motor frames, metal switch handles, all metal pipe frames for switchboard and switches, conduits, lead cable sheaths and in fact practically all metal that is not used as a current carrying conductor.

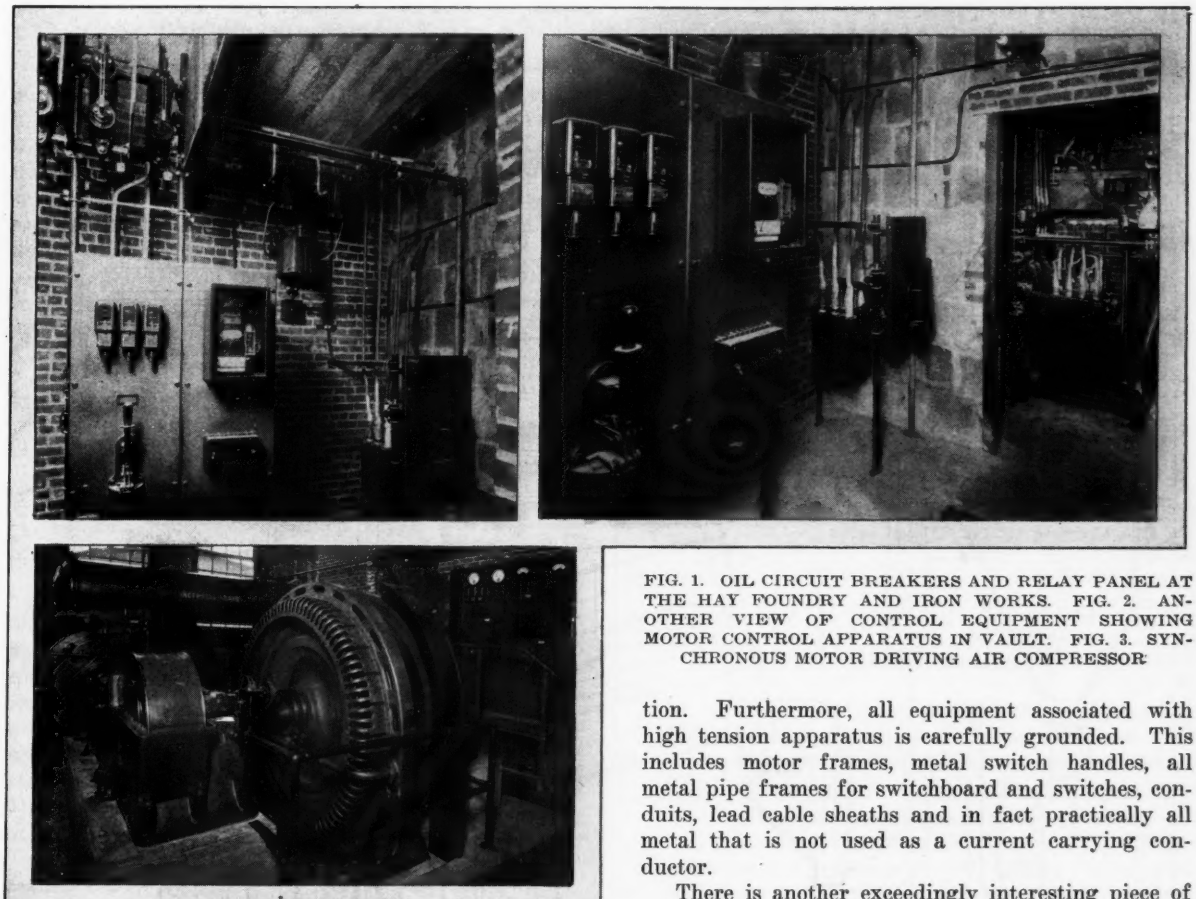


FIG. 1. OIL CIRCUIT BREAKERS AND RELAY PANEL AT THE HAY FOUNDRY AND IRON WORKS. FIG. 2. ANOTHER VIEW OF CONTROL EQUIPMENT SHOWING MOTOR CONTROL APPARATUS IN VAULT. FIG. 3. SYNCHRONOUS MOTOR DRIVING AIR COMPRESSOR

There is another exceedingly interesting piece of equipment made necessary by the introduction of a new type of electric drill and reamer designed not to stall and requiring 180-cycle current. This is a frequency changer consisting of a 30-hp., 440-v., 3-phase induction motor which drives a 180-cycle, 3-phase generator of corresponding capacity; the output of this frequency changer is 3-phase, 220-v. at 180 cycles.

GEORGE A. COOPER, who until recently has been superintendent of material for the Monogahela West Penn Public Service Co., has been appointed as Assistant Chief Business Specialist in the division of Simplified Practice of the Bureau of Standards, U. S. Department of Commerce. Mr. Cooper has had a wide experience in the actual application of simplified practice within the company for which he worked, inasmuch as his concern reduced their financial investment in inventory by 33 per cent and eliminated 16 per cent of items carried in stock through simplification.

Powerton Station is Added to the Illinois System

PULVERIZED COAL, UNIT MILLS, 650 LB. PRESSURE, REHEAT CYCLE AND 55,000-KW. UNIT ARE FEATURES OF NEW POWERTON STATION OF SUPER-POWER CO. WILL WHOLESALE POWER TO FOUR INSULL COMPANIES

DURING THE EARLY part of September, the first 55,000-kw. turbine of the Powerton Station of the Super Power Co. of Illinois was put into regular service. A second similar unit has been ordered and will probably be in service by the fall of 1929.

This station, located on the Illinois River about 2½ mi. from Pekin, Ill., will supply power to four Illinois companies—the Commonwealth Edison Co., the Public Service Co. of Northern Illinois, the Illinois Power & Light Co. and the Central Illinois Public Service Co.

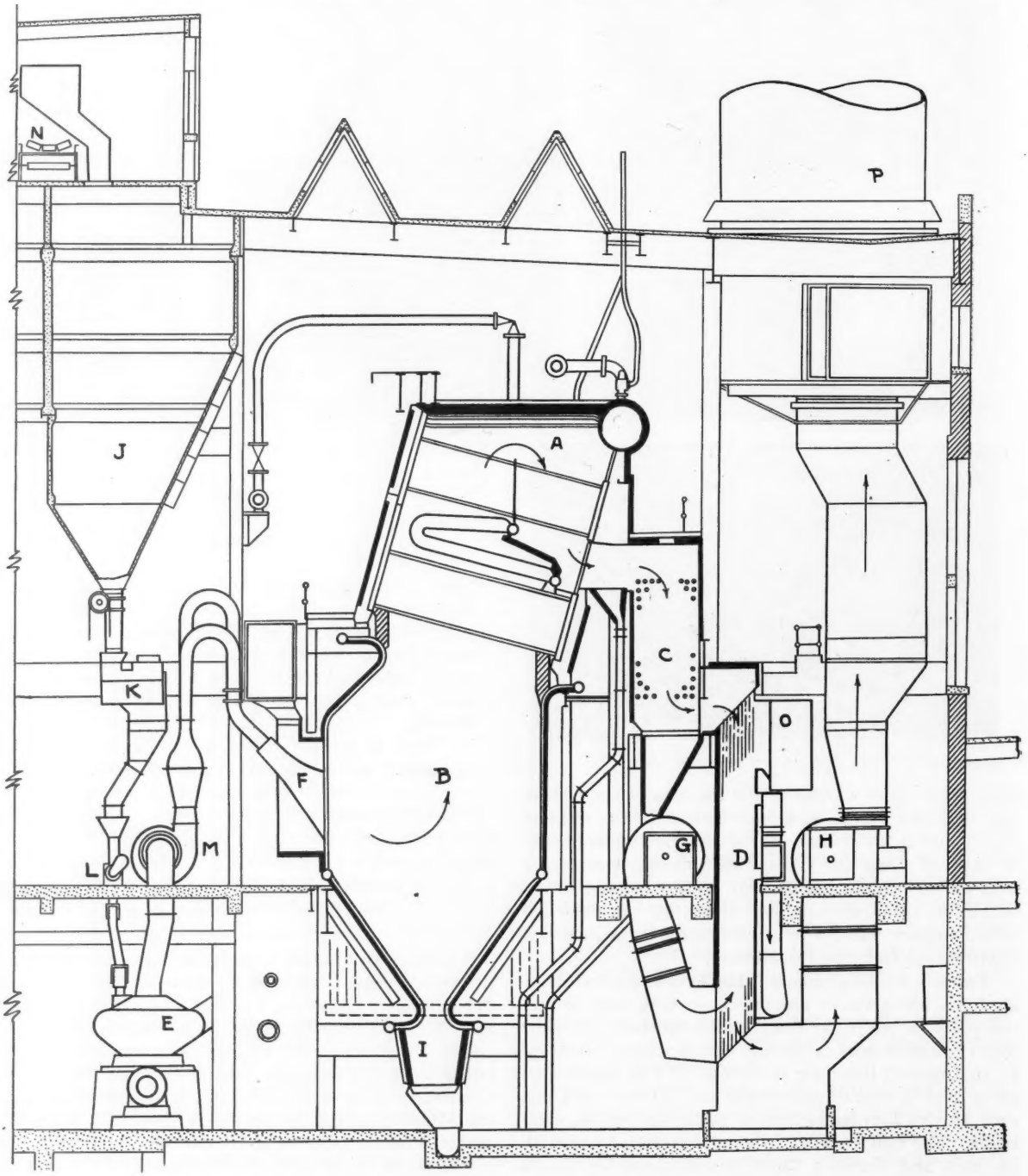


FIG. 1. SECTION THROUGH BOILER ROOM OF THE NEW POWERTON STATION NEAR PEKIN, ILL.

It is understood that the allotment to the different companies after the second unit is completed will be in the neighborhood of 31,000 kw. for the first two, 32,000 kw. for the third and 10,000 kw. for the fourth named company.

Boilers will be operated at 650 lb. gage pressure. The reheat cycle will be used with two normal and one reheat boilers installed in the first section. Normal boilers have 18,994 sq. ft. of heating surface and are each equipped with a 6126-sq. ft. economizer and a 29,450-sq. ft. air heater.

No Economizer on Reheat Boiler

In the reheat boiler, the total heating surface of 26,196 sq. ft. is divided so as to give 5340 sq. ft. in the high pressure section and 20,856 sq. ft. in the reheat section. A 25,997-sq. ft. air heater will be used with the boiler but, as the exhaust gases will be at about the same temperature as the normal boilers with the economizer, no economizer is installed on this reheat unit. All three furnaces are water cooled.

Illinois coal from the Kincaid district will be burned in pulverized form under all of the boilers. An analysis of Kincaid coal from Christian County, Illinois, is as follows:

Carbon, per cent	63.58
Hydrogen, per cent	4.66
Nitrogen, per cent	1.02
Oxygen, per cent	11.00
Sulphur, per cent	4.49
Ash, per cent	15.25
B.t.u. per lb., dry	11,800
Average mine moisture, per cent	14.50

Two unit mills are installed for each boiler with one exhauster, driven by a squirrel cage motor, supplied for each mill. Each exhauster supplies two burners, making four burners per boiler. Mills for the normal boilers are 54-in., air-separation type, with a capacity of 10 t. each per hour while mills for the reheat boiler are the same type but are the 48-in. size with a capacity of 7½ t. per hr. each.

No Coal Dryers Installed

Drying of the coal will be done in the mills. There will be no dryers installed, but an arrangement has been provided to put heated air into the mills. This air is bled from two points on the air heater. By regulating the proportion of air from each opening on the air heater casing, proper temperature of the inlet air to the mills can be obtained.

Raw coal is fed to the mills by two drag feeders operated by direct-current motors. No dryers are installed, drying of the coal being done in the mill and arrangement being made to heat the air going to the mills. A cross section of the boiler room is shown in Fig. 1. This section and boiler room data were included in a recent report of the N. E. L. A.

Referring to the drawing, raw coal is brought into the boiler room on the belt conveyor N, so located that it can supply the present bunker J, or a similar bunker which will eventually supply a battery of boilers on the opposite side of the aisle. From the bunker J, coal passes through the scales K and the drag feeders L to the pulverizers E. From the pulverizers the powdered coal is fed, by the exhauster M, through the turbulent burner F to the refractory covered water cooled furnace B.

From the furnace, the gases travel through the first pass of the boiler with its interdeck superheater, the 2-in. tube economizer C (26 tubes high and 18 tubes wide) and the tubular air heater D to the induced draft fan H on their way to the stack P. Air for combustion is forced by the fan G through the counterflow air heater D, to the air duct O, from which it is distributed to the mills and burners.

The turbine is a 55,000-kw. tandem compound unit, with a direct connected house generator, operating on the reheat-regenerative cycle. This unit will be set over a 55,000-sq. ft. divided water box condenser connected to the turbine by a water-sealed expansion joint.

FIG. 2. MAP SHOWING THE RELATION OF POWERTON STATION TO THE NORTHERN ILLINOIS SYSTEM. ONLY PROPOSED OR CONSTRUCTED LINES OF 66,000 V. OR HIGHER ARE INDICATED

Two 42,500-g.p.m., 193-r.p.m., circulating water and two 500,000-lb. per hour condensate pumps are installed. The vacuum pumps are three stage ejectors.

Station Built Near Coal Fields

Power will come from this new station to the Calumet Station in the Chicago district over 132,000-v. lines via Kewanee, Seneca, Joliet and Chicago Heights. The map, Fig. 2, showing proposed or constructed transmission lines of 66,000-v. or higher in this district and the location of Powerton Station, was taken largely from a larger map published in the Electric Power Survey of the Great Lakes Division of the N. E. L. A.

Speaking before the A. I. E. E., H. B. Gear said, "The development of an economical station in this locality not only provides for future growth in this part of Illinois but will effect large savings in fuel and operation cost, by producing energy now generated in smaller and for the most part, much less efficient stations. Most of these stations will be shut down except for the peak hour shift."

As always, there was much discussion regarding the relative advantages of shipping coal and generating current at the point of consumption or generating current near the coal fields and transmitting it over high voltage lines to the center of population. Another matter which is fast becoming a serious problem in the Chicago district is a suitable supply of condensing water.

Powerton, located as it is, but 70 mi. from the coal fields supplying the major portion of the Chicago power stations, has a considerable advantage in this respect as these same fields are some 200 mi. from Chicago. Again the Illinois River, which supplies condensing water has a maintained flow during the dry season because of the flow of water from Lake Michigan through the Chicago Drainage Canal.

Economic Development of Cahokia Analyzed

AT SECOND NATIONAL FUELS MEETING OF THE A. S. M. E. THE OPERATING AND INVESTMENT COSTS OF CAHOKIA STATION WERE DISCUSSED. BY E. H. TENNEY*

CAHOKIA STATION of the Union Electric Light and Power Co., St. Louis, Mo., was the second central station in this country designed for pulverized coal and in the three sections built consecutively over a period of six years most of the major developments in pulverized coal are represented. These developments have been along the following general lines:

1. Reduction in power consumption of mills.
2. Reduction in wear on mill parts.
3. Simplification or elimination of drying equipment.
4. Reduction in wear or elimination of coal transport equipment.
5. Improvements in combustion control, by burner and furnace design and by preheated air.
6. Reduction in furnace refractory erosion by the use of water walls.
7. Elimination of slag by various means.
8. Increase in heat liberation per cubic foot of furnace volume by use of water walls, greater turbulence and preheated air.
9. Simplifying the disposal of ash.
10. General combination of the above improvements leading to adaptation of pulverized-fuel systems to districts offering coals of widely varying characteristics, and to markets offering very poor or "distress" coal.

A COMPARISON OF THE POWER CONSUMPTION AND OPERATING COSTS OF AUXILIARIES AND INVESTMENT COSTS OF FIVE BOILER UNITS AT CAHOKIA STATION

Boiler No.	No. 3	No. 11	No. 13	No. 14	No. 17
	Operating Costs—Power Consumption				
Raw coal handling, cents per ton	4.9	4.9	4.9	4.9	4.9
Ash handling, cents per ton	1.4	1.1	1.1	1.1	0.8
Slagging and cleaning boilers, cents per ton	1.9	1.8	1.8	1.8	0.7
Coal preparation					
Operation, cents per ton	9.5	9.5	9.5	9.5	5.0
Maintenance, cents per ton	10.0	11.6	11.6	11.6	7.2
Power and lubricants, cents per ton	7.4	7.6	7.6	7.6	5.0
Total, cents per ton	26.9	28.7	28.7	28.7	17.2
Power consumption, kw-hr. per ton					
Raw coal handling, kw-hr. per ton	0.4	0.4	0.4	0.4	0.3
Mills and exhaust fan, kw-hr. per ton	16.0	16.0	16.0	16.0	15.5
Dryer fan, kw-hr. per ton	2.5	2.5	2.5	2.5	....
Air transport, kw-hr. per ton	3.3	3.3	3.3	3.3	....
Primary air, kw-hr. per ton	5.3	5.6	5.6	5.6	....
Draft fans, kw-hr. per ton	....	....	4.7	....	6.7
Feeder motor, kw-hr. per ton	1.0	1.0	1.0	1.0	0.4
Total power consumption, kw-hr. per ton	28.5	28.8	33.5	28.8	22.9
Cost at 0.3 cents per kw-hr., cents per ton	8.5	8.7	10.1	8.7	6.9
Boiler operation, cents per ton	25.2	25.2	25.2	25.2	23.0
Boiler feeder, draft maintenance, cents per ton	6.6	6.6	8.4	6.6	6.0
Boiler setting maintenance, cents per ton	13.5	1.6	1.6	1.6	1.6
Boiler and furnace fuel economy, cents per ton	14.0	8.0	2.0	12.0	....
Increment, West Kentucky coal, cents per ton					
Summary operating costs, cents per ton	96.1	79.6	76.8	83.6	56.3
Increment over latest installation	39.8	23.3	20.5	27.3	....
	Investment Costs				
Relative investment, boiler plant	1.000	1.056	1.173	1.039	1.139
Ratio of total hours available	0.68	0.78	0.79	0.80	0.82
Service-capacity factor, per cent	136	187	253	192	328
Relative investment, boiler capacity	1.000	0.768	0.631	0.736	0.472
Fixed charges per ton coal burned, dollars	4.62	3.55	2.92	3.40	2.18
Maximum capacity basis					
Total operating costs and fixed charges, dollars	5.58	4.35	3.69	4.24	2.74
Increment over latest installation, dollars	2.84	1.61	0.95	1.50	....

Notes: Furnace volume is measured from above center line of slag screen tubes to center line of lowest boiler tubes, except on boiler No. 17. On this boiler the volume is measured from the lowest row of boiler tubes to the horizontal center line through the hopper throat.
Width of furnace measured between sidewalls or between inner faces of tubes.
Fin-tube surface based on half entire perimeter of fin and tube screen surface for boiler No. 14 based on entire tube surface. Plain-tube surface of boilers Nos. 13 and 17 based on projected diameter of tubes, and bare iron surface is actual block surface.

In 1922, the initial installation consisted of four refractory-lined furnaces served by 6-ton mills in a storage system. This design is represented by boiler No. 3 in the tabulation. The next development was in 1924 when boiler No. 11 was installed with fin-tube side walls. Mills of 15-ton capacity were used in the coal-preparation plant. Next was the development of boiler No. 14 in which the side walls are water-cooled, with plain bare tubes recessed into refractory. This was followed by boiler No. 13 with fin-tube side walls and air preheaters and finally by boiler No. 17 which was equipped

*Chief Engineer of Power Plants, Union Electric Light & Power Co. See Power Plant Engineering, page 600, June 1, 1928.

with complete water-cooled walls and air preheaters and served by direct-fired mills and horizontal burners.

Rating and Time Available for Service Determines Unit Cost

The entire development has of course been closely dependent upon first costs. The increased maximum boiler rating has been accomplished with the same size of furnace and space occupied as the earlier installation, with the resulting reduction in investment per unit of boiler capacity. Figures indicating these changes are set forth in the table. To visualize more clearly what these comparative costs have been, the investment for each unit has been converted into a ratio, taking boiler No. 3, of the original installation, as unity. Thus, boiler No. 17 cost 13.9 per cent more than No. 3.

This cost includes complete expenditures for the steam plant, including coal and ash handling, building, coal-preparation equipment, boilers, furnaces and all boiler room equipment. These unit costs have been adjusted to a common basis of maximum steaming capacity. As boiler No. 17 can be operated at twice the rating of No. 3, the investment on the capacity basis is half.

In setting up a capacity study not only the boiler rating but the relative outages for maintenance should be considered. Thus the early boilers have an outage factor for slagging and cleaning which is greatly reduced with the latest installation. On the other hand, the latest installation has an outage for repairs to unit mills. As a true measure of capacity, a combination of maximum rating and outages has been set up in a "service-capacity factor," this factor being the product of the percentage of maximum boiler rating and the percentage of total hours the boiler is available for services, divided by 100.

It is suggested that such a figure gives a truer indication of boiler performance than maximum rating alone. In using such a figure for comparison, it must be realized that the outage for repairs is partly under control of the operators, in that maintenance can be speeded up, at extra cost, when necessary. For comparison of boilers within a plant, or between plants of similar load factors, however, this factor is of value.

On the basis of the service-capacity factors the annual interest charges on investment have been calculated for the total tons of coal burned in a year and prorated among the different types of boilers. The result is tabulated and shows that the latest installation when compared to the first, represents an appreciable saving per ton of coal burned.

Developments Allow Capacity to Be More Than Doubled in Same Space

That this is a tangible saving which can be realized upon is being demonstrated in a plant change now being carried out. Four of the first boilers are being changed to a type of firing and furnace construction similar to the most recent. A 35,000-kw. turbo-generator is being removed and a 75,000-kw. unit installed in its place, the new unit to receive steam from the same four boilers which served the original machine. Additional plant capacity is thereby obtained at an investment that is roughly 70 per cent less than the average for the plant.

Useless Waste of Life

By H. L. Williams

THERE was once an old saying that health could not be bought; but medical science has cast it upon the scrap heap with other moldy epigrams, superstitions and habits of thought. Health is being bought every day by millions of people. That is a cheering thought. Yet there is another side to the picture; namely, the appalling economic cost of preventable disease through loss of earning capacity, upkeep of hospitals and relief furnished to dependents.

One of the most expensive diseases is tuberculosis. In 1925 there were, in the country, 99,800 deaths from it. At the same time, there were approximately 898,000 active cases.

Fortunately, tuberculosis is preventable. From the experience of several health demonstrations made in recent years, it is believed that at a cost of from $2.50 to

$3.00 per person, a general health program could be adequately maintained in any American community. The tuberculosis death-rate has been reduced more than half in the past 20 yr. But thousands of lives that are still being wasted each year can be saved. Through the power of education in health habits, and through the media of clinics, preventoria and open-air schools, the organized tuberculosis campaign hopes to reduce the toll from this disease to a minimum. In order to expand its work still further, the National Tuberculosis Association and affiliated bodies are conducting the twenty-first annual Christmas seal sale in December.

Borlase Matthews, an electrical engineer who is a leader in the application of electricity to farm problems in England, reports an experiment in putting bees to work under the stimulus of artificial illumination considerably earlier in spring than the normal time for bees to leave their hives. He trained beams of light from electric lamps on the entrance of the hives. The bees were soon stirred to action, evidently believing that the first warm, sunny day of the season was at hand. They began to issue from the hives in search of food. When dishes of syrup, artificial pollen and water, and big vases of flowers were placed in their vicinity, with the lights still burning, they began to feed as hens do when the hen houses are artificially lighted before dawn.

A vocation is born to all of us; happily most of us meet promptly our twin—occupation.—Balzac.

Improving Power Station Operation

ACTIVITIES for power station betterment may be divided into two distinct classes, according to a recent N. E. L. A. report. 1. Changes in the procedure of handling existing equipment so that a higher degree of efficiency can be obtained. This may necessitate minor capital investments such as the installation of control instruments or devices, to permit more economic and intelligent control of the equipment but will not require major capital expenditures for improving the plant efficiency as a whole. 2. Changes in the equipment installed, either by the entire substitution of part of the plant apparatus or the addition of heat reclaiming devices to the existing equipment.

It is felt that in any procedure for power plant betterment the first step is to obtain the maximum results from the existing equipment before any expenditure of capital is made for improvements, except where it is self-evident that capital expenditure is the best method to cure a trouble, at the same time yielding a satisfactory return on the investment.

There are cases where the installation of additional apparatus might show a considerable saving on its installation cost if installed in a poorly operated plant, whereas, if this plant were operated up to its highest attainable efficiency, it might not be possible to justify the installation of the same device.

Voluminous Records No Indication of Efficient Operation

In attacking the problem of bettering the operating conditions in an existing plant, it is necessary to have definite knowledge of various underlying factors controlling them. A list which itemizes the majority of these factors is given below. This list must, of necessity, be general; items may be added to it or subtracted from it, depending on the design of the particular plant concerning which information is desired.

1. Physical performance of plant.
2. Production cost for plant.
3. Housekeeping procedures.
4. Training of personnel.
5. Standardization of operating procedures.
6. Standardization of plant records.
7. Budgeting operating costs.

Some of these items are so closely related that it is almost impossible to make a definite separation; for example, the matter of record keeping is very closely associated with physical performance of the plant, and the former should be so standardized as to aid in checking the performance, since it is not only necessary to know the efficiency of operation of the plant as a whole but also the condition of each part or section.

Record keeping in many plants has grown up much like Topsy and, in many cases, much time is spent in collecting records which are almost useless as a guide in intelligently following plant performance, or giving information that readily shows where losses are occurring, so as to permit the operator to correct these conditions.

In many cases, the tendency is to feel that voluminous records of plant performance are indications of efficiency, while, as a matter of fact, just the reverse is the case. Records should be concise and give only that information which is necessary, thus eliminating the effort of collecting and compiling a large amount of useless data.

Fourth Midwest Power Conference Elects Officers

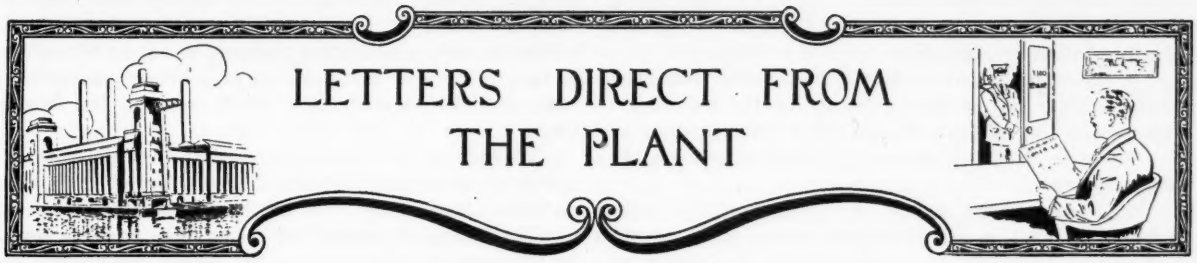
ELECTION OF OFFICERS for the Fourth Midwest Power Engineering Conference to be held Feb. 12—15 at Chicago, Ill., has recently been announced. The officers are as follows: president, W. L. Abbott, Chicago; vice-presidents, C. C. Whittier, Chicago; A. A. Potter, Lafayette, Ind.; C. F. Hirshfeld, Detroit, and W. M. White, Milwaukee; secretary, G. E. Pfisterer; treasurer, K. A. Auty, Chicago. Headquarters have been established at 53 W. Jackson Blvd., Chicago, Ill.

The conference will be sponsored as before by the local sections and regional divisions of the following societies: American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Institution of Mining & Metallurgical Engineers, National Electric Light Association, Western Society of Engineers, National Safety Council, American Society of Heating and Ventilating Engineers, American Society of Refrigerating Engineers.

Official hotel headquarters will be at the Palmer House where the entire fourth floor has been reserved for meetings, lunches and receptions. Meetings are open to all persons interested, regardless of membership in the sponsor societies but participating members must conform to registration rules.

Several committees have already started work for the four-day meeting so that the latest ideas in power work will be presented. Several sessions are already planned covering specialized activities such as heating, refrigerating, mining, electrical transmission and application, ventilating and coal utilization. Leaders of prominence in the various societies will be invited to participate by providing original papers or leading in the discussion.

For the Fourth Power Show, to be held at Chicago Coliseum from February 12 to 16 inclusive, reports from the management indicate that the entire Coliseum will be filled with exhibits of a diverse character illustrating the progress and latest practice in the entire power field. One of the outstanding features of the show at Chicago, the management states, will be the coördinating of exhibits of the same class. This is being attempted for the first time with the object of simplifying and saving time in the inspection of the hundreds of exhibits. It is expected that grouping of the allied products will give the visitor a better idea of the show, allow more time in the desired zones and eliminate time wasted in search of particular displays. Demonstrations of all types of machinery in actual operation, fuel burning equipment, pumps, heating and ventilating equipment and power transmission apparatus will receive their full share of attention.



Clearance Space Affects Pump Performance

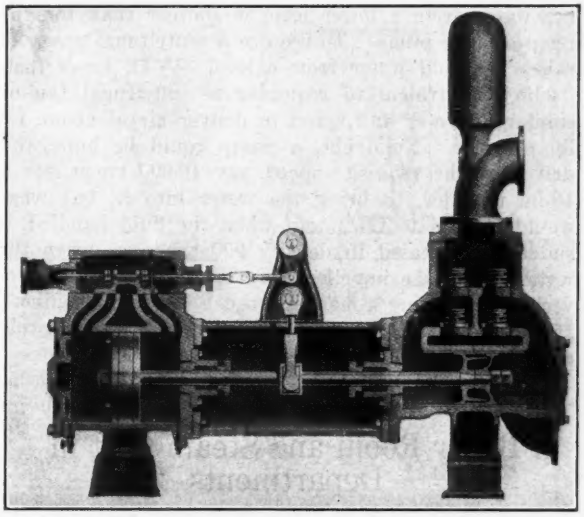
RECENTLY the question asked was, "Is it practicable to raise water of 180 deg. F. with a centrifugal pump, the lift being 3½ ft.?" A correct answer might be that the attempt would result in complete failure. The force causing water to flow into a pump is that due to the pressure of the atmosphere and is measured by the difference of pressure between the outside and inside of the pump, which pressure difference must overcome the frictional resistance of the piping and produce the necessary velocity, these two items being practically negligible in a proper installation.

In order that the water may flow into the pump, a difference of pressure must be established; this is accomplished, in the reciprocating pump, by moving the piston to and fro and, in the centrifugal pump, by rotation of the impeller. In all cases, the reduction of pressure tends to evaporation of the water, this tendency increasing with the decrease of pressure until, at the pressure corresponding to the vapor pressure of the water, actual boiling takes place.

To illustrate what takes place when a piston pump is applied to the work of raising hot water from a lower level, let us assume that a pump is set at an elevation of 3½ ft. above the water supply and that the temperature of the water is 180 deg. F. The space between the water level and the pump is filled with a mixture of air and vapor having a combined pressure equal to that of the atmosphere. Water at a temperature of 180 deg. F. has a vapor pressure of 7.5 lb., which is about one-half the pressure exerted by the mixture of air and water vapor of total pressure of the atmosphere, or 14.7 lb. If the air were removed from the suction pipe containing this mixture, the resulting pressure would be that of the vapor, or 7.5 lb. and the pressure of the atmosphere on the surface of the water in the hot-well would force the water up to a height of nearly 17 ft. Of course, in a practical pumping installation the air is not removed from this space for, if it were, there would be no difficulty about lifting the water a mere 3½ ft.

Before going farther, let us consider one of the structural features of the direct-acting steam pump. The illustration showing a cross section of the water cylinder indicates how exceedingly large the clearance space is as compared with that of the steam-engine. In the submerged piston type of pump, this clearance volume is nearly, if not quite, equal to the volume swept through by the piston. In the straight-way type, the clearance volume may exceed the piston volume. This large clearance explains why a direct-acting steam-pump cannot function successfully as an air compressor, although it is sometimes tried. While the pump may be driven by compressed air instead of steam, the converse, or compressing air in the water cylinder, cannot be done because the reëxpansion of the air in the clearance volume fills the cylinder on the suction stroke, preventing the entrance of additional air.

Returning to the problem of pumping hot water, the pump is started. Instantly, the pressure above the water is reduced by the removal of some of the air-vapor mixture. Were the water at the temperature of



LARGE CLEARANCE SPACE IN WATER CYLINDER PREVENTS PUMPING OF HOT WATER BECAUSE OF RE-EXPANSION OF VAPOR

the atmosphere, the quantity of vapor would be comparatively slight and a few strokes of the pump would bring the water into the cylinder. But, in the case under discussion, the temperature of the water is 180 deg. F. and the volumes of the air and the vapor are about equal, so the first stroke of the pump removes a small quantity of the air, which is quickly replaced, however, by the air normally carried in solution by the water.

We saw that the clearance volume of the cylinder was about equal to the volume swept by the piston, so that at the end of the first suction stroke, the cylinder would contain the air originally present, also the air and vapor taken from the suction pipe. The vapor, coming in contact with the cool air and cylinder walls is cooled and a portion of it condensed, so that the pump begins the discharge stroke with a cylinder containing air and small quantities of vapor and water. The pressure required to open the discharge valves,

which may be several pounds per sq. in., causes a further condensation, so that, at the end of the stroke, pressure is barely enough to open the valves.

On the second suction stroke, the air that had been compressed to the opening pressure of the valves, re-expands and a portion of the water reëvaporates, so that there is too little pressure difference to open the suction valves.

All the foregoing events are influenced by leaks through the suction and discharge valves and past the piston, also by the heat resulting from the friction of the piston on the cylinder walls; the latter becomes quite evident after running a short time.

Seemingly, the reason a direct-acting steam pump cannot handle hot water is because of its construction, which provides a large clearance space. If the water cylinder were constructed like a steam engine cylinder, with a minimum of clearance, there would be much improvement in the ability to handle hot water, although such a pump would have a limited application because there are few cases where the hot water cannot be made to flow into the pump under a head.

Explanation of why a centrifugal-pump cannot raise hot water from a lower level is simpler than for the reciprocating pump. To require a centrifugal pump to raise even cold water from a level 3½ ft. lower than itself is equivalent to requiring a centrifugal fan of similar diameter and speed to deliver air at about 1.5 lb. pressure. No doubt, a pump could be built and driven at the requisite speed, say 10,000 r.p.m. for a 10-in. impeller, to bring the water into it, but what would happen to the pump when the fluid handled is suddenly increased in density 900 times, as when the water enters the impeller, may be likened to the proverbial "throwing a monkey-wrench into the machine." If the impeller stood the shock, the shaft would probably be twisted off in a twinkling.

Los Angeles, Calif. C. O. SANDSTROM.

Boiler Room and Steam Cost in Departments

YOUR INQUIRY in the August 1 issue regarding the proper method of charging for steam used by the various departments in an industrial plant touches one of the most delicate duties of the progressive power plant engineer.

In all of my experience, I find that nowhere is greater diplomacy required than to get the operating and accounting departments together on neutral ground. As a rule, either the accountant is strong enough to force his method on the engineer or the engineer bluffs the accountant into believing that the power plant is too technical for anyone but an engineer and so forces his ideas and methods down the accountant's throat.

As a matter of fact, it really makes little difference in the end because, being non-productive, the expense of the power plant must be divided among the other departments. The final output of the mill is the same, regardless of how the details of steam distribution costs are worked out. The important point is to keep the system consistent. A good engineer will know what his plant is doing, regardless of the work of the accounting department. Unbalanced distribution charges and accounting methods cause the engineer considerable concern in trying to explain to the management why a particular item in power costs is so much higher than before in such and such a factory, when, as a matter of fact, if the real facts instead of bookkeeping figures, were available, the charges would probably be found lower.

Whether or not the steam used in the boiler room has to be considered directly, depends largely upon the methods of metering. If all the boilers are metered, usually the total amount of steam generated is used by the accounting department for cost distribution. In this case, the steam used by the station auxiliaries may either be subtracted from the total produced to get a net production or, more likely, the cost of steam used there is a direct charge against the boiler room like that for water or coal. Paradoxical as it may seem, this method has certain advantages, especially when power also is made, and simplifies the system for the accounting department.

If a battery of boilers generates 1,000,000 lb. of steam per day, using 100,000 lb. of it for boiler and auxiliaries, and the total expense is, say $900 per day; in the end the steam supplied to it is costing the factory, as a whole, $1 per thousand pounds, no matter how the accountant juggles accounts.

I have always felt, however, that the better method is to meter the steam to the various departments, including the turbine or engine room, if any, and consider this total as the net output of the boiler room. In the case above, this would amount to 900,000 lb. per day or $1 per thousand. This gives the same unit cost in the end and avoids a fictitious charge against the boiler room. After all, it is the net cost that is of material significance. With this method, there would be no direct charge against the boiler room for the steam used because this steam would not show on the report. Indirectly, it is considered and the more steam used in the boiler room, the less is available for the outside or net supply.

Of course, from the engineer's standpoint meters at both places are desirable, as they give him a check on his individual boiler performance and give a fair distribution to each department. Furthermore, one set checked against the other insures continued alertness on the part of the operatives, to see that the meters are working properly.

Judging from the case given in your August 1 issue, as many plants do, they simply estimate or meter the steam to each department, use it as a percentage of the total and prorate the total boiler room charges. In this way, the boiler room steam need not be considered.

St. Petersburg, Fla. PAUL F. ROGERS.

Some Belts Not Affected by Water

IN HIS ARTICLE on Belt Saved by Stretching on page 1109 of the October 15 issue Mr. Hobart neglected to mention that belts are now on the market that need not be saved by stretching because they are waterproof in the first place. They do not fail in the manner described by Mr. Hobart.

For example, I know of one belt that is not only proof against cold water but is also proof against hot water. The other day I attended the Metal Exposition in Philadelphia where I saw this belt. It was actually

being boiled in water, and the boiling appeared not to harm it in the least. Ordinary leather belting, however, could not stand such treatment. Of course waterproof cement is used on this modern belt.

The last two sentences in Mr. Hobart's article are as follows: "All the cauls used, both those of veneer and those of plain board, were well heated before being applied to the belt and were put in place and clamped while they were as hot as the hand could bear. Such a degree of heat will not injure leather." According to one leather belt authority, oak tanned leather belting should not be subjected to a temperature higher than 115 deg. F. Mineral tanned leather belting should not be subjected to a temperature higher than 215 deg. F.

Newark, N. J. W. F. SCHAPHORST.

Prepared Tin Foil for Packing Purposes

HOMEMADE ARTICLES seldom equal those manufactured by a reputable, experienced concern but many power plant superintendents are pleased when their engineers make up devices and so reduce the initial expenditure for material or equipment.

Tin foil has often been proposed for packing a rod. Such foils can be made into a fairly good packing, if they are correctly prepared. But when scrap foil of all sizes is used with no addition or preparation, it will generally prove to be unsatisfactory. The foil, both heavy and light, can be bought in small or large rolls of any desired width for about 35 cents a pound.

There are two good ways of preparing a packing of tin foil; first, take a fairly heavy foil, about 6 in. wide and roll out several feet on top of a table. Spread a strip of thin cheap cotton of the same dimensions on top of the foil, then coat it well with powdered graphite mixed thick with oil by means of a stiff brush. Add several similar sheets of foil and prepared cotton. The layers are then rolled up into cylindrical form and laid away until needed.

Asbestos sheet $\frac{1}{32}$ in. thick can be used instead of the cotton but it will require a graphite coating on each side. A piece of this sheet can be cut off and used as rod packing. It also makes an excellent flange packing, but it is difficult to cut out the bolt holes. Where gaskets are required, it is better to prepare a separate roll for that purpose and have the asbestos sheet attached to the tin foil with shellac.

When using this packing for flanges or other flat surfaces, it should be given a coating of graphite before setting the washer or gasket in place. Such a gasket will seldom blow out and will never spread beyond the safe limit.

Toronto, Canada. JAMES E. NOBLE.

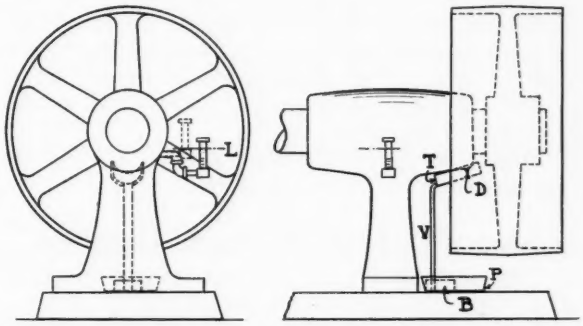
Oil Pan Stops Drip Onto Belt

OIL COMING from one of the bearings of a centrifugal pump continually dropped on the belt and kept it soaked. Several attempts to stop this action proved futile. It was presumed that the oil worked from the bearing out along the shaft to the end and into the pulley and was then thrown by centrifugal action onto the belt. Close observation proved, however, that the oil dropped from the end of the bearing to the inside of the rim of the pulley instead of following the shaft to the end. This was possible because one end of the pulley encompassed the end of the bearing. The trouble was also aggravated by an oil gage which was set so high on the bearing that the oil would run out of the end of the bearing before it would show on the gage.

Sheet metal, in the shape of a trough, as shown in the illustration at T, having a vertical leg V bent down at one end, was placed under the end of the bearing as shown. Before installing this trough, the bottom end of the leg V was set in a mold made of clay and molten lead poured into the mold. When the lead as shown at B cooled off, it acted as a foot which could be set on the pump foundation to hold the trough at the proper height.

After installation, the oil dropping from the bearing flowed down the trough and vertical leg onto the foundation of the pump, so much oil working that a pan P was finally placed there to catch it.

Lowering of the oil gage as indicated, which was done by connecting it with two street ells as shown, made



OIL GAGE RELOCATED AND SHEET METAL TROUGH SAVES OIL AND BELTING

it possible to observe the height of the oil without waiting until it overflowed at the height L. These improvements helped in keeping pump house tidy, saving oil and preserving the belt.

Coffeyville, Kan. P. A. GETT.

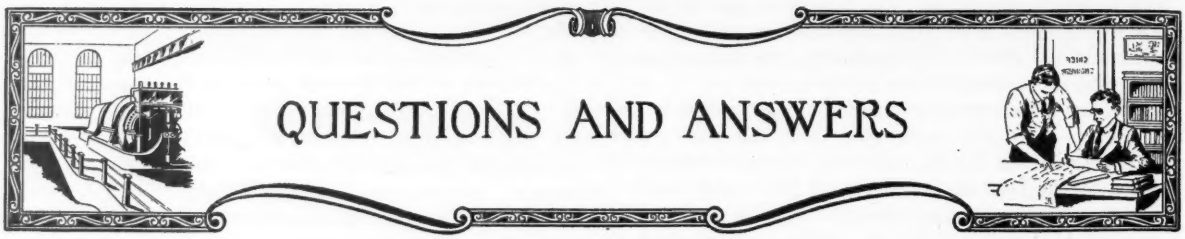
Spiral Tube Cleaner for Ammonia Condenser Scale

DOUBLE-PIPE ammonia condensers can be easily cleaned of scale by the use of a spiral-spring tube cleaner. One of these of suitable size was fitted to the end of a 20-ft. length of $\frac{3}{8}$-in. gas pipe. The other end of the pipe was drawn down to fit the chuck of a $\frac{5}{8}$-in. portable electric drill.

In using this device, the water return bends were first removed from the condenser. A strong stream of water was then introduced into one end of a tube by means of a hose and the tube cleaner operated by the electric drill, which is run at full speed. This, acting as a reamer, is slowly pushed through from the opposite end of the tube.

This method is hard on the tube cleaner but no damage results to the electric drill. The first time this method was used it resulted in reducing the head pressure from 185 lb. to 160 lb., with water coming from the condenser at 82 deg.

Dixon, Mo. BENNETT SKAGGS.



Rigid vs. Flexible Couplings

IN THE ARTICLE about the Gennevilliers Station, published on page 920 of the Sept. 1 issue, I note that some of the units are fitted with flexible couplings. This is contrary to American practice, which always dictates the use of rigid couplings in which case the entire shaft acts as a single unit. Knowing the hard service that these couplings get, I wonder how a flexible coupling could be designed to stand up under it. Of course, it simplifies the bearing problem considerably but one would naturally assume that in Europe they would use the rigid coupling and that in this country, the flexible coupling, to allow for misalinement of bearings, might be used. It would be interesting to know the opinion of readers on this point. P. F. R.

Editor's note: The foregoing question is placed before our readers for their discussion.

Steam Passage Through Engines

HOW DOES STEAM enter and leave the following engines: Corliss, uniflow and poppet valve? C. B. S.

A. Steam enters the Corliss cylinder at the top and passes through the steam chest to the steam valves which

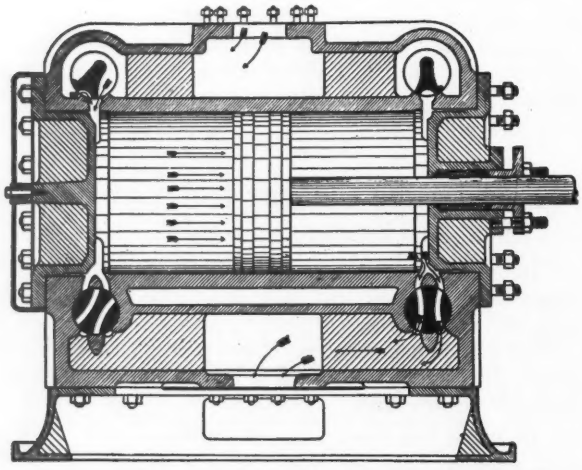


FIG. 1. STEAM FLOW THROUGH CORLISS ENGINE

are always located at the upper corners of the cylinder as shown in Fig. 1. The exhaust valves are always at the bottom as shown, the steam passing out to the exhaust pipe at the center.

In uniflow steam engines, the distinguishing feature of the flow of steam is that it is always in one direction and not, as indicated in the case of the Corliss or other type of steam engine, reversing in direction over the same surface during each complete rotation of the flywheel. The steam in the uniflow engine passes out of the cylinder through ports in the center and the piston is long in design so as to operate as a piston valve in opening and closing the exhaust ports as shown in Fig. 2. The uniflow principle is used to reduce condensation within the cylinder during admission of steam by avoiding the cooling of the cylinder surface from flow of the low temperature exhaust steam over it.

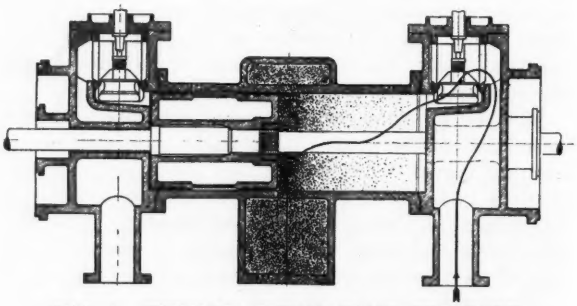


FIG. 2. UNIFLOW STEAM FLOW PRINCIPLE

Flow of steam is not governed by use of poppet valves. Such valves may be used either on four valve engines or on uniflow engines, as shown in Fig. 2. Likewise uniflow engines may be supplied with valves other than those of the poppet type. The principal advantage of the poppet type over all sliding valve types such as the D, Corliss or piston types is that they are better adapted for use with high superheat steam, since they rise from their seats without sliding over them so that scoring action is avoided when lubrication is meager.

If the poppet valve is used with a four-valve type engine, the valves are located similarly to those of the Corliss engine, the steam valves above the cylinder and two exhaust valves at the bottom of the cylinder.

Pump Packing and Maintenance

PLEASE ANSWER a few questions for me.

1. Metallic packing in the piston rod stuffing-box leaks considerably and I would like to know whether this would be any cause of not getting the proper amount of vacuum that should be obtained. I am running a Cooper engine connected to a jet condenser.

2. I would also like to know whether it is advisable to use a little soft packing with metallic packing on the piston rod. If so, should it be placed between the gland and case or between the case and cylinder?

3. Also, how do you go about installing new metallic packing in a piston rod stuffing-box?

4. I would like to know of a good way to examine all joints on a jet condenser to see whether they are air tight.

5. How do you tell a right-hand engine from a left-hand?

6. How do you go about removing the brass linings in the water end of a pump?

7. Also, how do you secure the new ones in order to keep them from turning?

8. Is it best to have new plungers and follower plates put in when you replace linings?

9. How much clearance should there be between the lining and plunger?

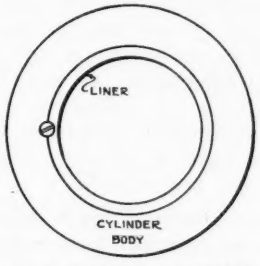
10. What is the idea of a gage connected to the discharge line of a boiler feed pump? W. F. W.

A. Leaky stuffing-box packing would reduce the efficiency of your pump and therefore reduce the amount of vacuum you could obtain by use of the pump.

2. Soft packing is often used successfully with metallic packing. It is usually used between layers of metallic packing and not next to the gland or bottom of the stuffing box.

3. You can obtain best information regarding the installation of any certain kind of metallic packing by writing the makers.

4. If the joints of a jet condenser be covered with soap suds, air bubbles will indicate any leakage at such points.



SCREW TAPPED IN PARALLEL TO LINER AND BETWEEN LINER AND CYLINDER BODY ACTS AS KEY

5. Whether an engine is right or left-handed is determined by the relation of the flywheel to the cylinder. If the flywheel is at your right when you are viewing it from the cylinder head, the engine is said to be a right-hand engine.

6. Before removing the brass liner of a pump, it should be allowed to cool after being shut down and the plunger and other running gear dismantled. If the liner is little worn, a flat bar may be placed across the inner end so as to engage the two sides of the liner without protruding over the liner at any point. This bar should be provided with a rod which projects through the cylinder and to which a jack or heavy nut is attached. At this outer end, another bar is attached which engages the cylinder casing so that, on operating the jack or turning the nut, the liner is pulled out.

If the liner is badly worn, a narrow groove may be cut by means of a cape chisel parallel to the sides. This will relieve the pressure on the sides. In some cases, it is necessary to cut this groove only a few inches from each end in order to release the grip of the liner.

7. Pump liners may be prevented from turning by keying them with a screwed rod which has been centered on the joint so that half of the rod is in the liner and the other half in the casing. The hole for the rod should be drilled parallel to the axis of the cylinder.

8. Whether or not to install new plungers and follower plates when renewing a liner depends upon how much the plungers and plates are worn. The liner, being of brass, usually takes most of the wear and under ordinary circumstances renewing of plunger and plates should not be necessary, although the best condition of fit will result, if all parts are renewed.

9. The amount of clearance between liner and plunger depends upon the size of the pump and differs with different makes. We would advise, therefore, that you write the makers of the pump for information regarding the amount of clearance they allow.

10. A gage is connected to the discharge line of a boiler feed pump in order to show the pressure at this point. A drop in pressure for a given speed would indicate leakage or other lack of proper operation.

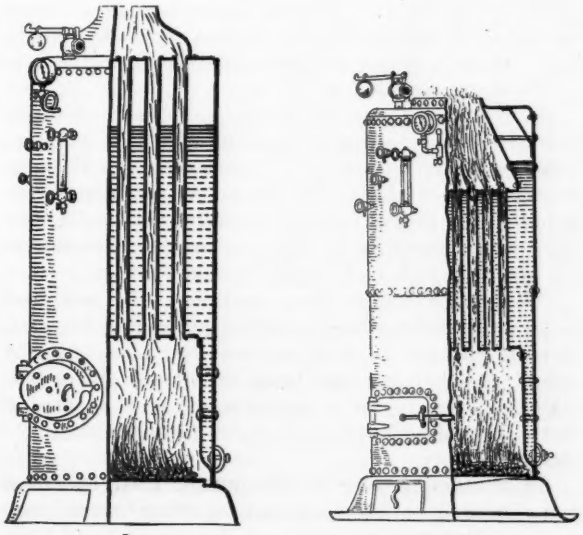
Boiler Stays and Braces

How are the following types of boilers stayed: B. & W., Heine, horizontal return tubular, vertical tubular and locomotive? C. B. S.

A. Babcock and Wilcox boilers have no stays.

Heine boilers have no stays for the shell but the water legs are braced with 1.66-in. diameter hollow stays.

Horizontal return tubular boilers have diagonal braces, riveted to the shell and riveted to or attached to angle irons on the heads, above the tubes. Below the tubes, through rods are attached to the rear head



A—STAYS IN VERTICAL TUBULAR BOILER. B—SUBMERGED TYPE OF TUBULAR BOILER SHOWING STAYS AND BRACES

by pins which pass through angle bars; at the front head, the rods are held by inside and outside nuts.

All vertical tubular boilers are braced around the firebox which has staybolts through the outer shell into the firebox sheet, as shown at A in the illustration. Vertical tubular boilers of the submerged type have diagonal braces from the shell to the upper head also screwed stays from the head into the cone as shown at B.

Locomotive type boilers have their heads braced by diagonal stays and the side sheets of the firebox by screwed stays having a $\frac{3}{16}$-in. hole in the center. The crown sheet is stayed in a similar manner and by cross girders over the top.

EDITORIAL COMMENT

Good Operation Pays

Effective operation and adaptation of equipment to conditions to be met are of as great importance as working out the most advanced ideas as to heat cycle. This is recognized by many engineers of even the largest central stations, who experiment with forward-looking equipment but place their main reliance on conservative, proved installation with the best possible operation.

To show what can be done, the record of the station at Padiham, England, is an instructive example. With pressure of 250 lb., superheat to 620 deg. F., vacuum of 29.4 in. and exhaust steam heating of feedwater to 120 deg., an average yearly thermal efficiency has been attained of 20.61 per cent, with coal having a heat value of 12,000 b.t.u. per pound.

Condensate, by use of a steam-sealed hot well, is kept practically free of oxygen and by lime-soda and zeolite treatment the make-up water is made of zero hardness and slightly alkaline, so that blow-down is only a few inches a month and boiler cleaning is reduced to brushing out once a year.

Equipment is brick-set, land-type boilers with longitudinal drums, working at a rating of 3.8 lb. evaporation per square foot of heating surface. Two 7500-kw. units and one of 15,625 kw. are served by three circulating water pumps, each of capacity to handle one-third of the water for the two condensers. Economizers are cast iron, with no bleeding or stage heating.

With these conservative conditions, the combined boiler and furnace efficiency is 80.5 per cent and overall thermal efficiency is 19.82 per cent based on delivered output, or 20.61 per cent based on kilowatt-hours generated during a year's operation. And a surprising fact is that the plant cost only $60 per kilowatt of installed capacity.

In the design, ease of continuous, good operation and elimination of all equipment requiring unusual care and attention were the chief considerations. Good operation—that was the factor depended upon for results. The results speak for themselves.

Cracked Heads

Repair and replacement costs in Diesel practice have been high in the past, due largely to breakage of large and expensive parts such as cylinders and cylinder heads.

Efforts to overcome such breakages have been devoted almost exclusively to the use of better materials, employment of better casting methods including the application of chills in order to avoid formation of porous sections and recourse to better design not only of the cylinder jacket with relation to its liner but latterly more especially with a view to definitely directing the flow of cooling water.

Formerly it seemed to be sufficient merely to enter the cooling water at one point of the cylinder and remove it at another; little thought seemed to have been given to avoiding air pockets of any kind, therefore to the prevention of unequal heating of parts. Developments in design of water cooling systems have led to an understanding of the need of entering the cooling water at the lower points in each elemental section requiring cooling by water and drawing off the heated water at the uppermost point of such sections and of passing the water through the various elemental sections, in the order of their discharge temperatures.

Importance of avoiding the adhesion of air in fine globules to the heated surfaces that are supposed to be cooled by water circulation, has been understood by engineers for years but it is not yet receiving the consideration it deserves in the design of internal combustion engine water cooling systems. Water should be passed through the jackets at a sufficiently high velocity to cause the heated surfaces to be washed rapidly and uniformly with cool water at all times in order to accomplish most desirable heat transfer.

The relation of cracked cylinder jackets and heads to hard water has not generally been understood until recently. Water softening systems have become regular equipment of Diesel plants. Great care is now being exercised to adopt that system of softening which produces best results under the particular circumstances under which it is to operate, consideration being also given to removal of concentrate.

As a result of the development indicated and the use of indicating and recording temperature instruments and of adequate daily records, with which the better types of Diesel plants are now provided, the reliability of this form of motive power has been greatly increased.

Water cooling systems deserve the same intelligent engineering consideration usually given to other design features of internal combustion engines notwithstanding the apparent greater importance of the latter when considered from the standpoint of safety of action.

If good engineering consideration is given to the above mentioned factors, there should no longer be any cracking of cylinder jackets or heads and reliability and low cost of maintenance will be assured. Wherever such breaking occurs on engines installed within the past few years, it will be almost invariably found that although this is only one of possibly several contributary causes, the final trouble lies with untreated cooling water.

Don't Put All Your Eggs in One Basket

Speaking before a joint gathering of the Western Society of Engineers and the Institute of Radio Engineers in Chicago recently, Capt. Ranger of the Radio Corporation, in recounting the development of radio picture transmission, outlined the procedure used in the

laboratories in attacking new problems. Each major problem, said Capt. Ranger, is usually attacked from two entirely different angles, two lines of investigation being conducted simultaneously without respect to each other. Usually, in the course of time, one of the two lines of attack proves more fruitful than the other; one, in fact, may develop limitations which make it desirable to discontinue further research by that particular method. The unsuccessful method is then dropped and an entirely new method of attack decided upon. This new method is then developed in parallel with the original and thus the problem is gradually brought to a solution.

This procedure has much to recommend it and is applicable in all branches of research. It recognizes the existence of limitations and precludes the tendency to follow blindly a rut which leads nowhere.

In power plant practice as well as in the radio field, this method of research or investigation has application. In the development of power plant equipment, there is a tendency to develop new devices upon principles which have proved successful in former apparatus. This is an admirable plan and one to be adhered to in any line of research, but in addition entirely new ideas should also be worked out. The same applies in the investigation of power plant trouble, such as caustic embrittlement, corrosion, deterioration of furnace linings. The investigation of these troubles along a number of different lines simultaneously will do much to hasten their correct solution. It is merely a case of the age old proverb of not putting all your eggs in one basket.

Off Duty

In a world where "four out of five" have it, where Halitosis and B. O.'s scream their warning from every advertising page, where the deadly caffeine in coffee is slowly poisoning entire nations, where to eat meat inevitably results in the dreaded high blood pressure and arterio sclerosis, where the ghastly dandruff lurks in every derby and where fallen arches are the price of nonscientific foot gear, what chance, doomed reader, we ask you—what chance has the average mortal of attaining the proverbial "three score and ten"?

Of course, there are remedies for all these things; for dandruff, for instance, one has only to douse one's dome in Blisterene; arterio sclerosis can be held at bay successfully by imbibing large quantities of sourkraut juice distilled under the auspices of the American Institute for the Promotion of Cabbage Culture, but even so, there are only 24 hours in a day and one cannot spend all the time warding off disease. Furthermore, the Amalgamated Golf Ball Growers insist that at least two hours a day of golf is vital to one's existence. What is one to do?

Are you overweight? solemnly inquires the paid advertisement of the Life Extinction Institute. Are you losing pep? You men over forty, do you know what your blood pressure is?

The Life Extinction Institute asks these grave question, not with the idea of being funny—indeed no; the Institute is never funny, it has a great "Service" to offer. It will add ten years to your life, provided you want them. The Institute is only one of many prosperous organizations whose doctrine is that diseases which shorten life after middle age are often silent and that by means of regular bodily examinations such diseases can be detected in time to permit of successful treatment. Like other organizations of its kind, the Institute has wonderful laboratories with high powered x-ray equipment and vast arrays of stomach pumps all presided over by learned M. D.'s. Its impressive quarters teem with pretty nurses whose warm touch will quicken the pulse of the T. B. M. and so bring on the first symptoms of duodenal ulcers. In short, the laboratories are impressive as also are the fees.

While the good faith of the promoters of such organizations may be assumed, there is nothing resembling scientific proof that periodic physical examinations of adults result in any extension of life whatever.

On the contrary, as pointed out in a recent article in the American Mercury by Logan Clendening, associate professor of medicine at the University of Kansas, such examinations, health audits as they are called, often result in much unhappiness and harm.

Dr. Clendening, who proceeds on the basis that most people are a good deal healthier than they think they are and that things are not nearly as bad as they seem, has examined in considerable detail all the evidence presented by the health auditing institutes and finds it of the same general character as that submitted by Ponce de Leon.

If the human body were a machine like a gasoline engine in which worn parts could be replaced or thoroughly examined by taking it apart, the theories of the health audit clinics might be of value, but it is not. It cannot be put together again, once taken apart, and with the exception of the teeth, worn parts cannot be replaced. To offset this disadvantage, however, the human body is a living, growing organism and by its nature makes automatic and effective adjustment and compensation for defects as they arise.

From long experience, medical men know that the majority of patients complain of ill health long before there are any physical signs, or signs detectable by mechanical or electrical aids. No external aids to diagnosis are as sensitive as the patient's own symptoms. True, there are diseases which advance insidiously and silently but in few instances can delay in recognizing them be said to be detrimental. When diseases of this kind have indicated their existence, there are prescribed methods of treatment available but as to their prevention, nothing is known. Yet it is *prevention* that the health audit institutes stress above all other things.

Their claims lead one to believe that the only factors affecting longevity are diet, exercise, procedure of living. Little, if anything, is said of hereditary influence. Yet hereditary influence is perhaps a more important factor affecting longevity than all others combined.

Raymond Pearl, the biometrician, conducted an investigation by having a clipping bureau furnish him with the name and address of any person celebrated in the press for having lived to a ripe age. On sending these people questionnaires, he received a large number of answers and upon classifying them, he concluded that the most potent factor which influenced length of life was a family history of longevity.

The health clinics may prescribe diets and issue bulletins on girth control, and riddle patients with x-rays to their hearts content but it will be a long time before they will be in a position to furnish them with complete lines of hardy ancestors.

Power, Its Generation and Its Uses on Display

PLANT CONSTRUCTION AND EQUIPMENT, MACHINERY FOR UTILIZING AND APPLYING POWER IN VARIOUS FORMS WILL BE EPITOMIZED AT GRAND CENTRAL PALACE, NEW YORK, DECEMBER 3 TO 8, 1928

HERE, UNDER one roof, at the National Exposition of Power and Mechanical Engineering, and conveniently arranged for study will be gathered plans, equipment and supplies of interest to all power plant men, whether engaged in small or in large stations. Here, also, will be found experts in every line of steam, electric, heating, ventilation, transmission, refrigeration and factory engineering, ready to assist in solving troublesome problems or to suggest means and methods for improving plant efficiency and cutting down costs of operation.

PROGRESS CAN BE STUDIED

That attendance at the Exposition, to study exhibits and gain new view points and ideas from the knowledge and experience of others, will offer a great opportunity is self-evident.

New devices and improvements are constantly being offered. Here is a chance to see what they are and what

they will do. Manufacturers and engineers are ever gaining experience. Here is a mine of information to be worked by the visitor with an inquiring and attentive mind.

Every piece of equipment seen may not at this moment be applicable to your plant or conditions but surely some will be and, at almost any time, you may find others desirable.

In such a show, the exhibits will be found to cover: Engineering staples about which the engineer should know; machinery and methods, which are presented for the first time or are comparatively new in the field; improvements in equipment and methods to keep up with advanced practice. All these are subjects worthy of study by the engineer who is seeking to keep himself and his plant up to date.

EXHIBITS TO BE CLASSIFIED

For the convenience of visitors, the exhibits will be divided into the following departments: Power Plant, Machine Shop, Heating and Ventilating, Transmission, Safety Devices, Refrigeration, Material Handling, Marine. Strict classification cannot be followed, as many exhibits will have equipment in two or more departments, but such division, so far as possible, makes for a saving of time and concentration of thought.

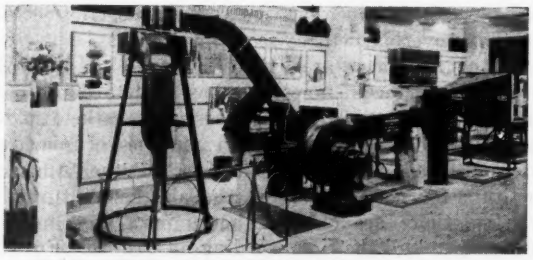
For those who will visit the Exposition, and all who can will surely wish to do so, the best use of time requires the making of a definite plan of action. Why is one going? Obviously, to see, to ask, to listen, and to learn.

PLANS FOR EACH VISIT WILL SAVE TIME

What does one wish most to learn about? Certainly such equipment and methods as are of immediate interest for use in his plant.

What are, have been and will be your greatest needs and problems? This visit gives a chance to help meet them and find answers. How?

First decide what those needs and problems are. Second, go over the descriptions of exhibits and pick out the equipment likely to be of help. Mark the booths of manufacturers on the floor plans with some symbol as



X. The first visit should be planned to cover those booths in the most effective way.

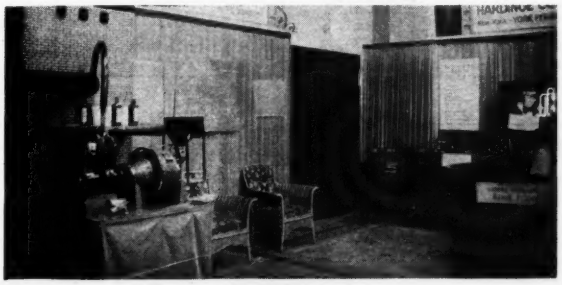
As you go over the descriptions, check those which have features that you wish to investigate and mark the corresponding booths on the floor plans with another symbol, say ♯. The second visit should be planned to go over these. This will be a big order and it may take more than one visit to the Show.

DATA ARE WORTH PRESERVING

How can one best profit from the information and ideas gained? There will be much to see and the human mind can retain and assimilate only a limited number of ideas at once. Some permanent record is needed for

future reference. Here comes in the note book, which every live engineer should always carry, only, in this case, it will be well to have one specially prepared for the occasion.

There will be some 450 exhibits, of which a considerable number will be on your marked lists, so a book of convenient pocket size with a generous number of pages will be needed. If the booths to be visited be listed in the proper order, it will make note taking easier and serve as a route guide. A full page should be allowed for notes at each exhibit and memorandum made of the features to be investigated. The balance of the space will be for notes while visiting the exhibit.



After each visit to the exhibit, it will be well to go over the notes taken, to see whether additional information is wanted and to be sure that all data secured have been recorded. It is so easy to fill in any gaps on a subsequent visit to an exhibit and so difficult to do a few months later when you may want the missing facts.

Other visits will be made, of course, to look over exhibits not on your lists, to talk with representatives and to swap experiences. All the time you can get may profitably be spent in the various booths and, if the note book is kept working, you will carry away a mine of information and suggestions for future study and use in your daily work.

Location of and How to Reach the Exposition

Grand Central Palace is located on Lexington Ave. between 46th and 47th Sts. It is reached by the Lexington Ave. surface cars, by the East side elevated or subway trains and from the West side subway by the shuttle cross-over at 42nd St. Exhibits will be open each day from noon until 11:00 p. m., Dec. 3 to 8, inclusive.

Location of booth numbers will best be found by a study of the floor plans. Booths 2 to 95, also A and B will be on the main floor, Nos. 201 to 347, also 2E and 2M on the mezzanine or second floor, Nos. 401 to 563, also 3E, 3F, 3N and 3M, on the third floor, Nos. 600 to 773 will be on the fourth floor. The moving picture auditorium will be on the fourth floor, where pictures of industrial processes will be shown, the times of showing to be announced and posted on bulletin boards.

Films have been secured as follows: From the Norton Co., The Handling of Heat, a one-reel exposition of the use of refractories in industry. Four reels on The Age of Speed. From E. F. Houghton & Co., five reels on The Story of Vim Leather, showing the progress from raw material to finished product. From The Timken Roller Bearings Co., two reels on The Manufacture of Timken Steel Roller Bearings. From Fyre-Freez Corp., one reel, Freezing Out Fires by Carbonic Gas. From Weston Electrical Instrument Corp., five reels covering Principles and Action of Electrical Measuring Instruments. Controlled Heat and The Heat Thief, two films on control of fire and transmission of heat energy from the Hoffman Specialty Co. From Walter Kidde & Co., one reel on Controlling Fire in the Dip Tank. From Stone & Webster Engineering Co., three films; one of three reels illustrating the growth in use of power from the time of Newcomen and Watt; one of two reels demonstrating the development of electrical energy from coal; one of three reels on Conowingo, showing the process of building the water power plant on the Susquehanna River, second only to the plants at Niagara Falls.

Following is a list and description of exhibits and

of special features for your convenience in planning your trip.

Power Plant Engineering will be found in booth 38, where we shall be glad to see you at all times, to serve as a meeting and resting place, or to aid in making appointments, securing information or solving power plant problems.

Directory of Exhibits

Abbe Engineering Co., Booth 90
50 Church St., New York, N. Y.

Pebble mills for paint grinding and pulverizing and rotary cutters for cutting up scrap material will be found here.

Representatives: H. F. Kleinfeldt; H. C. Russ.

Absolute Con-Tac-Tor Corp.,
Elkhart, Ind. Booths 306, 307

Products will be shown covering five different fields, namely: A standard line of mercury switches, applicable to many types of switching apparatus; a complete line of control and safety devices for domestic and commercial oil burners; similar equipment to cover control of electric refrigerators both domestic and commercial types; coal burning equipment, booster fans and the like; automatic control for industrial heating systems governed by unit heaters. A first showing at other than a strictly oil burning convention will be made of the company's new and sensitive thermostatic equipment in both plain and clock models. In these switches, contact is made or broken by electrical connection through a rolling quantity of mercury, the tubes being tilted sufficiently to accomplish this purpose. The tubes are filled with an inert gas to prevent corrosion of the contact points, which avoids any wear or deterioration. Contact is made and broken inside the tubes, thus avoiding any spark which could start fire outside.

Representatives: L. A. M. Phelan, president; Joseph Zwolanek, sales manager; J. C. Bogle; H. F. Dever, sales engineer; G. P. Gregory, engineer of eastern distributing agency; H. E. Lake, engineer of eastern distributing agency.

Accurate Brass Casting Co., Inc., Booth 502
Cooper and Wyckoff Aves., Brooklyn, N. Y.

Here will be found brass and copper forgings and castings to demonstrate the special work which this company does in these lines.

Representatives: Chas. M. Rose, sales manager; Otto E. von Au.

Advance Engineering Co., Booths 271-274
168 Washington St., New York, N. Y.

This company acts as New York representative for the Armstrong Machine Works, Smith-Monroe Co., A. W. Cash Co., Templeton Steam Trap Co., Barrett Machine Co., Chicago-Wilcox Mfg. Co. and Instant Water Heater Sales Division. Armstrong steam traps will be shown, including a glass trap in actual operation under 5 lb. steam pressure to illustrate working conditions and freedom from air binding. Gast compressed air separators will be demonstrated showing the removal of water from compressed air. Templeton boiler feed and pumping traps will be shown in a working hook-up, demonstrating the handling of condensate and direct return to the boiler under pressure. Cash standard valves, Mosher separators, Cadman blowoff valves. and the Instant steam water heater will be shown in sectional models.

Representatives: For Advance Engineering Co., Chas. W. Gill, Robert Bristow, Arthur S. Thomas, Fred Croes, C. Wilson Gill; for Armstrong Machine Works, O. E. Ulrich, Thomas Rea; for A. W. Cash Co., Paul Temple; for Templeton Steam Trap Co., Wm. R. Templeton; for Barrett Machine Co., Chas. A. Saints; for Instant Water Heater Sales Division, H. B. Fridstein.

Aerofin Corporation, Booth 14A
Newark, N. J.

Apparatus for heating or cooling air will be displayed and the action demonstrated.

Representatives: Herman D. Jackes, sales manager; George W. Barr; William L. Peplinger; Robert M. Stikeleather.

PLAN OF MAIN FLOOR BOOTHS 2 TO 95

Alexander Brothers, Inc., Booths 269, 270
14 South St., Phila., Pa.

Tentacular transmission belting will be shown in this exhibit and several typical installations will be displayed showing the belting running under normal operating conditions. The belting is of special construction to give high adhesion to the pulleys and the elimination of air pockets. On a backing of either oak tanned leather or balata are attached narrow longitudinal strips of green leather, made by a special process and held in position by hollow brass rivets. Tests of the belt will be made at the Show and also illustrations of its adaptation for slow speed and heavy pull, for high speed and for short center drives.

Representative: J. L. de Rabot, consulting engineer, in charge of booth.

A. Allan & Son, Booth 4
Harrison, New Jersey.

Allan products will here be shown, including Red Metal segments for facing pistons, Red Metal for various packing purposes, cored and solid bushings, metal valve discs, metallic packing for locomotive piston rods and valve stems. A special feature will be the Allan Red Metal rings for Diesel engine and air compressor pistons, a product recently perfected for such use.

Representatives: Andrew Allan; William T. Allan; Henry Chandler; J. Jay Vandergrift.

Allen Air Appliance Co., Inc., Booth 30
452 Lexington Ave., New York, N. Y.

Products to be shown in this space will be air filters, ash handling equipment, blowers, centrifugal air compressors, dust collectors, exhausters, turbo blowers and industrial and institutional vacuum sweeping systems. Special features to be demonstrated will be turbo blowers and sweeping systems which will be shown in operation.

Representatives: F. C. Allen, Jr.; L. B. Hardtla; R. J. Heller; E. W. Vickery; Thomas F. DuPuy; I. E. Bickhart; T. H. Hillery; E. Failmezger; James J. McEwen; G. S. Withham, Sr.; Joseph F. Garand; E. J. McEwen; Frederick H. Mason; E. H. Parker.

Allen-Bradley Co., Booths 537, 538
Milwaukee, Wis.

Here a complete line of direct-current, automatic compression resistance starters and alternating-current across-the-line switches will be shown. Also, there will be displayed the company's Resistotransformer starter, a new development,

combining the advantages of the compensator, with the compression resistance starter. Various control stations and other accessories of interest to the ventilating, heating and refrigerating industry will be demonstrated. As a special feature, two operating exhibits will be shown to demonstrate the results which can be obtained from the use of graphite compression resistance in starting alternating-current motors. Several new devices relating to the overload protection of small motors as used in ventilating, refrigerating and heating systems will be demonstrated.

Representatives: F. F. Loock, general manager; G. O. Wilms, chief engineer; A. J. Dawe, assistant engineer; C. N. Calkins, New York office manager in charge of exhibit.

Allen & Billmyre Company, Inc., Booth 74
Grand Central Palace, New York.

Covering a general range of the products manufactured by the company, the exhibit will include a 5-hp. vacuum cleaning plant, a low-pressure blower, a high-pressure blower, and a ¾-hp. portable vacuum cleaner. As a special feature, the new low-pressure blower will be demonstrated, of single stage construction and for as low as one pound pressure.

Representatives: J. F. Billmyre, president; A. H. Kirkland, New York district sales manager.

The Allen-Sherman-Hoff Co., Booth 62
225 So. 15th St., Phila., Pa.

Here will be found an interesting scene-in-action picture of the Hydrojet system for the pumping of ashes and also full size model of the manganese steel vertical pump which the company has developed for this purpose. Action of the system and its advantages will be fully demonstrated and explained in literature available.

Representatives: John Deutsch, in charge of the booth; D. W. Simler.

The Allpax Company, Booth 560
Mamaroneck, N. Y.

Allpax products will be shown, specially featuring the practical demonstration of the application and use of these products. These cover packings for all purposes and especially a new packing known as Allpax in coil form.

Representatives: O. H. Funk, in charge of booth; William A. Harris; Charles H. Davis; E. D. Edgecombe; H. O. Doggett; J. E. Marwitz.

American Blower Co., Booths 314-22
30 Church St., New York.

Disc fans to 42-in., Sirocco blowers to 35,000 c. f. air per min., heaters for 100 to 250 sq. ft. radiation, all in operation.

Representative: R. A. Hamilton, manager ventilation department.

The American Brass Company, Booth 65
Waterbury, Conn.

Anaconda products will be shown here as follows: copper, brass, bronze and nickel-silver sheets, wire, rods and tubes; Admiralty and Ambrac condenser tubes; bare and weatherproof copper wire and cable; lead-sheathed power transmission cable; hollow conductors; preformed cable; seamless connectors; Everdur (manganese silicon bronze); commutator bars and segments; extruded shapes; die pressed parts; turbine blading; tobin bronze and other Anaconda welding rods; piston rods and shafting; Anaconda brass pipe.

Representatives: W. H. Dowd, exhibit manager; A. C. Risedorf; F. F. Thursfield; E. J. Linnewerth; F. H. Loomis; E. S. Wallace; C. N. Williams; G. W. Swentor; A. L. O'Brien; E. K. Sullivan; D. A. Parker; H. A. Buckbee; K. S. Roberts; C. S. Lindley; T. A. Conlon; J. A. Bates.

American Car and Foundry Co., Booth 201
30 Church St., New York, N. Y.

Three 3-electrode a.c.f. Berwick rivet heaters will be shown; also a 1-electrode heater for heating, for forging or upsetting. Explanation will be made of the effectiveness and cheapness of heating rivets by electricity and the operation of the heater will be fully demonstrated.

Representatives: F. C. Chester, sales agent; John S. Helt.

American Mason Safety Tread Co.,
Jersey City, N. J. Booth 434

Mason safety treads and walkways will be shown here for industrial and power plants, also special power plant treads for stairways and construction of boiler room and other flooring and grating. Stairways with various treads showing application to worn stone or wood steps, door saddles, ladder shoes, brass, steel and white brass treads, with carborundum and with lead filling will be displayed, also a sample stringer of structural treads designed for installation where a self-supporting step is needed. This step and the white brass tread are new and latest developments.

Representatives: H. A. Welcome, general manager; M. O. Lange; B. C. Fair; Fred Mollison of Joseph T. Ryerson & Sons, Inc.

American Oil Pump & Tank Co.,
Cincinnati, Ohio. Booth 697

American Model K and Model F force feed lubricators for engines and compressors will be shown in single and multiple feed types for link or belt drive. Operation of the company's oil filters will also be demonstrated.

Representatives: A. F. Gahr; R. D. Bayman.

American Pipe Bending Machine Co.,
37 Pearl St., Boston, Mass. Booth 564

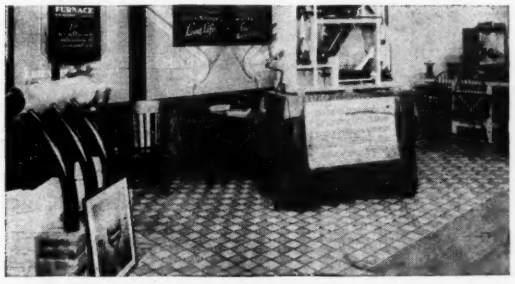
Three pipe benders will here be shown in operation, demonstrating the ease with which they are operated and the range over which they will operate satisfactorily.

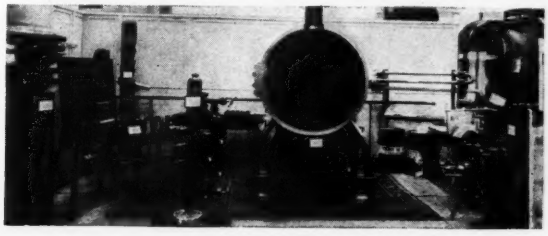
Representatives: Nelson J. Pepin; Edmond P. Blake.

American Pulverizer Co., Booth 19
1249 Macklind Ave., St. Louis, Mo.

A working model will be shown of the improved type S American ring crusher, also photographs illustrating types of ring crushers and important installations. The ring crushers which are made in capacities of 25-500 tons per hour have anti-friction tapered roller bearings mounted in heavily ribbed end castings. The housing is reënforced with ribs and adjustment can be made to regulate the fineness of the pulverized fuel.

Representatives: Joseph Kissick, Jr.; Geo. F. Fenno; W. J. McDonough; C. R. Fischer.





Ames Pump Company, Inc.,
Booths 629, 630
90 West St., New York, N. Y.

Vacuum heating pumps and condensate pumps will make up the display here with Ames duplex vacuum heating pumps showing the interior and exterior construction as a special feature.

Representatives: Charles F. Ames; R. H. Frederick; A. H. E. Berchem.

Appleton Electric Company, Booth 504
1701 Wellington Ave., Chicago, Ill.

The company's malleable and No-Thred Unilets and Reelites will make up the exhibit here. A special feature will be a new line of this product, showing the construction of the Unilets and the method of attaching conduit to the outlet boxes without the use of thread on the conduit, the joint being accomplished by means of a compression bushing and nut on the outlet box.

Representatives: Frank H. Merrill, vice-president; L. P. Swick; W. H. Chambers; W. H. Flandreau.

Arca Regulators, Inc., Booth 23
11 Park Place, New York.

Here will be illustrated Arca automatic control for pressure, temperature, vacuum, humidity, liquid level, density, speed, and the like. Pressure and temperature regulators will be shown in actual operation and other systems by detailed apparatus and photographs.

Representative: Walter S. Dickson.

The Armstrong Machine Works,
Booth 271
Three Rivers, Mich.

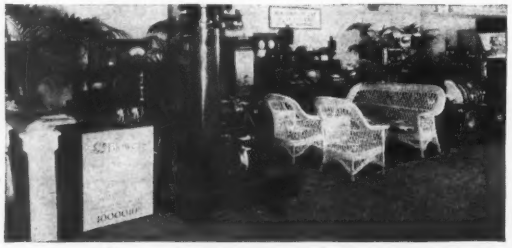
This company, which manufactures Armstrong steam traps, will exhibit a

complete line of traps including standard cast iron, steel for high pressures, the compound trap for handling large quantities of water at high pressures and other types. The exhibit will include a glass model of the Armstrong trap, operating on 5-lb. steam pressure to show the entire cycle of operation of the Armstrong inverted submerged bucket. The body of the trap, as well as the bucket, will be of glass. The demonstration will show how air binding is eliminated without wasting steam, the quick action of the valve which prevents wire drawing and valve troubles, and the self-scrubbing action of the trap to eliminate frequent cleaning.

Representatives: A. E. Armstrong; O. E. Ulrich.

E. C. Atkins & Co., Booth 457
402 S. Illinois St., Indianapolis, Ind.

Kwik-Kut heavy duty power hacksaw machines, style No. 18, and the company's Silver-Steel power and hand hacksaw blades will be displayed in this space.



Representatives: E. W. Clark, New York manager; Edward S. Norvell, manager metal cutting department; L. C. Garvin, A. H. Davis, B. M. Greenwood, J. I. Kip, W. H. Sherer, salesmen.

Atlantic Gear Works, Booth 626
16 Jefferson Ave., Brooklyn, N. Y.

The company's line of gears will here be shown including the Duro noiseless pinions.

Representative: George Scherr.

Atlantic Metal Hose Co., Inc., Booth 742
351 West 52nd St., New York, N. Y.

Flexible metallic hose and tubing, principally for heavy duty such as conveying steam, gasoline and oil will be shown here, some of the services for which it is used being the blowing of boiler tubes, testing turbines, conveying of transformer oil and for movable connections on platen presses.

Representatives: A. Rubin, president; W. C. Stansfield, sales manager; E. H. Ebin; W. D. Inman.

Atwood & Morrill Co., Booths 552, 553
Salem, Mass.

A complete line of bleeder equipment for turbine and condenser service, the company's regular line of reducing pressure valves with strainers, and a general assortment of small specialties to be used in connection with bleeder work, will be shown here. The main feature will be a pilot-operated relief valve, known as the 20th Century, with large piston, dash-pot for steadying operation and a by-pass. Another exhibit to be emphasized will be a 3-flow reverse current valve for low-pressure-drop service.

Representatives: C. P. Atwood; H. B. Morrill; John H. Leggett; L. Kimball.

Auburn Stoker Corp., Booth 61
Auburn, Ind.

The company's new Auburn Automatic Fireman under-feed stoker, particularly adaptable to low set and internal firebox boilers, will be exhibited. This stoker may be installed under boilers having but 12 in. clearance from the floor level to the bottom of the water leg. It is of the ram feed type, actuated by hydraulic pressure.

Representatives: B. O. Fink, president; Robert L. Fitzgerald, sales manager; N. E. Beers, assistant sales manager; John S. S. Fulton, chief engineer; H. H. Fitch, assistant chief engineer; S. B. White, field representative.

Austin, Mason Co., Booth E446
15 Park Row, New York, N. Y.

The company's Elastic metallic packing for ammonia, steam, air and acid systems will be displayed here, illustrating the details of this system and the application for various uses. Alternate fiber rings and metal compression rings are used, with metal end rings and wipers to hold packing in place and prevent escape of lubricating oil. Special new developments will be shown for carbon dioxide refrigerating machines.

Representatives: F. V. Austin, manager; Leo McConville; Miss M. Brothers.

Automatic Switch Company, Booth 497
454 Grand St., New York, N. Y.

Complete line of Asco valves will be displayed, including solenoid operated magnet valves for use with gas, air, water, brine or steam. These are made for all standard electric circuits and in various sizes and designs for different kinds of work. In addition to valves will be shown heavy duty relays, magnetic contactors and other like apparatus. The valves are solenoid operated either by direct connection to the valve stem or by operation through a series of levers to multiply or reverse the direction and pull.

Representative: W. F. Hurlburt, vice-president, in charge of the exhibit.

Automatic Water Softener Co., Booth 406
3421 Bigelow Blvd., Pittsburgh, Pa.

Displayed here will be a model softener, miniature in detail of a softener equipment having the capacity of 350,000 gal. a day. A working model of the softener will also demonstrate the means of operating the equipment, that is, the softener will be operated by means of the electrical conductivity of water passing through the softener to regenerate it automatically. Display will also be made of the working model of a special type valve employed in connection with the company's industrial equipment in which the water used to operate the valve passes around the piston instead of pressing against the lower side. The valve is, therefore, without piston or packing rings and of extremely simple construction.

Representatives: A. J. Dotterweich; F. B. Beech.

E. B. Badger & Sons Co., Booth 432
Boston, 14, Mass.

This company will exhibit single and multiple corrugation low pressure flanged joints, also Badger self-equalizing joints in both flanged and welding type.

Representatives: F. R. Heath, F. E. Lyons, H. W. Coombs, sales manager.

R. H. Baker Company, Inc., Booth 567
238 Main St., Cambridge, Mass.

This booth will be used as a reception space with pictures and literature describing and illustrating the company's installations and the service which it has to give to power plant men.

Representative: Roland H. Baker, president.

The Baldwin Chain & Mfg. Co., Booth 512
Worcester, Mass.

Power transmission chains and sprockets, steel roller chains, block chains, steel replacement chains, oil well chains, precision silent chains and sprockets will make up this exhibit. A power-driven unit of various sizes and types of chains and sprockets and a display board showing the samples of these will be special features. New developments are the larger use of alloy steels in the construction of chains and sprockets giving increased breaking strengths and longer life.

Representatives: A. W. Warren, sales manager; L. Clifton Havener; C. D. Schmidt, New York representative.

Barco Manufacturing Co., Booth 84
1801 Winnemac Ave., Chicago.

Barco lubricated plug valves, in straight-way, three-way and four-way form will be shown with screwed and flanged ends. Barco flexible joints, screw end and flange end, will also be shown as well as Barco metallic conduits. Special features of the exhibit will be electrically-operated conduits and cut-open sections of the valves and joints, also photographs of representative installations. As a distinctly new feature, the Barco swivel joint specially designed for the industry and for platen presses, tube molds, and the like, will be on exhibit. This has had good success during the past year and an electrically operated model will be displayed, together with the Barco steam-jacketed, lubricated plug valve, which is so constructed that passage of steam through a jacket at the large end of the plug keeps the valve and the fluid passing through at a uniform temperature.

Representatives: Arthur S. Lewis, district sales manager; R. P. Klein.

Barnes & Jones, Booths 312, 313
128 Brookside Ave., Boston.

Products to be shown in this space will include modulation, vapor and vacuum heating systems and in the line of steam specialties there will be found thermostatic radiator, vacuum return, blast, boiler return and vent traps. Valves will be shown including modulation steam and water type and demonstration will be made of the action of all these devices for use in vapor and vacuum systems.

Representatives: Walter E. Barnes; William T. Jones; H. B. Eells.

machines as loaned by prominent manufacturers.

Representatives: E. P. Langworthy, vice-president; G. H. Kendall, chief engineer.

R. H. Beaumont Co., Booth 50
319 Arch St., Philadelphia, Pa.

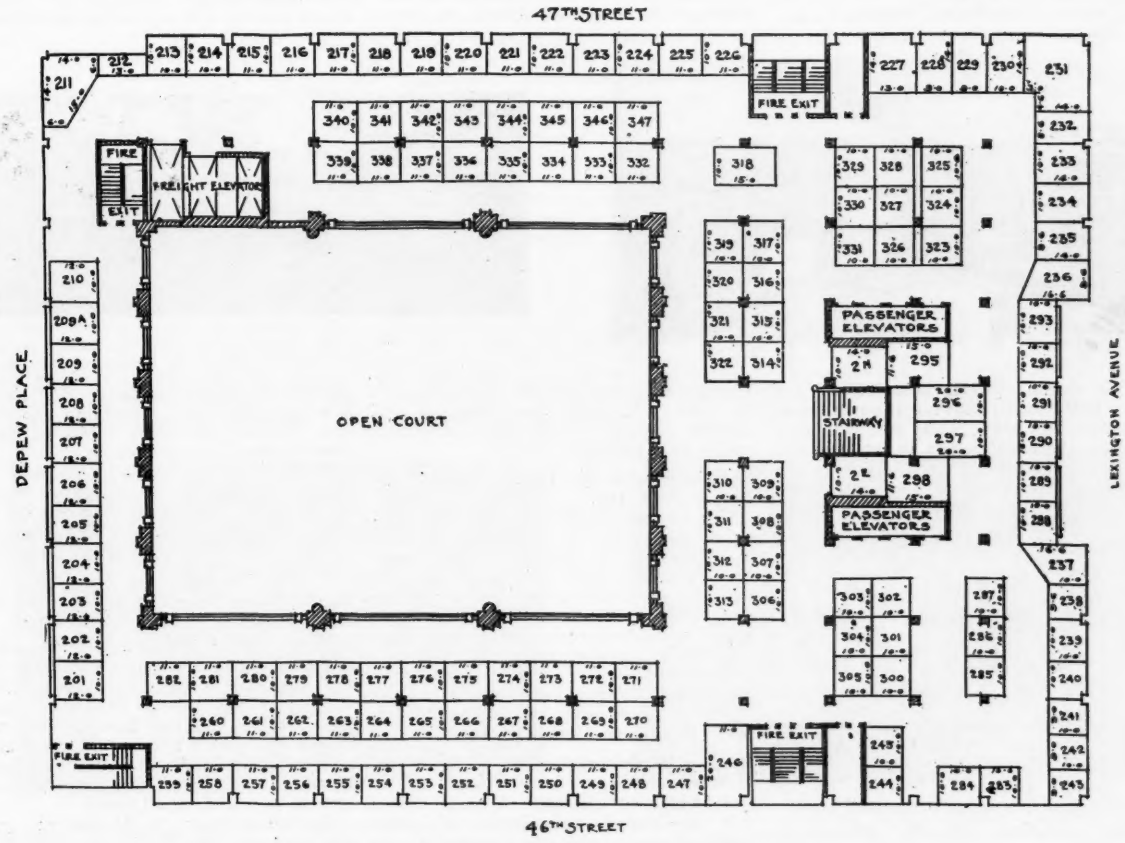
A working model will be on display of the Beaumont coal and ash handling system showing the construction and method of action of Beaumont improved skip hoist winding machine. The device will be shown in action and the flexibility of the system demonstrated.

and other electric portable flexible shaft machines will be demonstrated.

Representatives: R. Wezel, president; Francis I. Vanderbeek, Jr., in charge of exhibit.

Blaw-Knox Company, Booths 485, 486
Pittsburgh, Pa.

Blaw-Knox Electroforged steel grating and open flooring, regenerative air preheater and Tracyfiers for removing moisture from steam will be exhibited here. One feature of special interest will be several enlarged photographs, showing standard steel buildings and transmission



BOOTHS 201 TO 347 ARE ON THE MEZZANINE OR SECOND FLOOR

Beach-Russ Co., Booth 90
50 Church St., New York, N. Y.

Rotary vacuum and liquid pumps, rotary air compressors and gas boosters will be displayed and their operation demonstrated by this company.

Representatives: Charles A. Beach; Howard C. Russ; Arthur T. Beach; George Bussmann.

Bearing Industry Corp., Booth 444
1834 Broadway, N. Y.

Products to be shown here will be ball and roller bearings with special features illustrating the applications of these bearings for different purposes.

Bearium Bearings, Inc., Booth 290
261 Franklin St., Boston, Mass.

Sample castings of Bearium metal will be shown in cored and solid bars, also Bearium processed rods. Application of Bearium bearings to several pieces of machinery will be demonstrated by means of

Representatives: H. W. Ruth; H. B. Mosley.

Bentz Engineering Corporation, Booth 661
661 Frelinghuysen Ave., Newark, N. J.

Bentz air condition apparatus, featuring the Chillblast air conditioner cooler and dehumidifier will be shown; also the air washer and unit air conditioners which the company manufactures.

Representatives: W. E. Lowell, assistant to the president; Harry Bentz, Jr.; Vernon Cano, vice president; A. G. Luders, vice president.

Biax Flexible Shaft Co., Booth 417
20 East 17th St., New York, N. Y.

The main feature of this exhibit will be the company's newly developed portable die-sinking and rotary filing machine, and included will also be the necessary tools for die, pattern and mold work. Flexible shafting, flexible shaft grinders,

towers. A feature of the exhibit will be Electroforged steel grating shown as an actual installation, consisting of a raised platform of standard sized panels occupying about half the booth space and reached by two small stairways, with the Electroforged grating treads. This will show fully the strength and rigidity, the slip-proof feature, the protection against rust and cleanliness because of absence of rivet heads, slots, bolts or acute angles. the freedom of passage of light and air. A motor-driven model of the regenerative air preheater will be shown and the Tracyfiers will be represented by full-sized sections of a boiler drum type and an actual size pipe line apparatus to demonstrate the removal of moisture and dirt from steam, air, gas or vapor.

Representatives: D. Clinton Grove, advertising manager, in charge; H. B. Loxterman, assistant to general sales manager; Roger Andrews, sales manager,

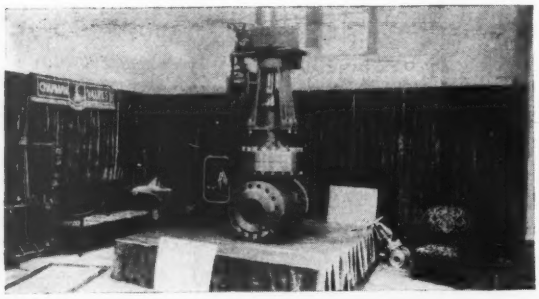
Tracyfier department Andrews-Bradshaw division; E. J. McDonnell, sales manager, steel plant equipment department.

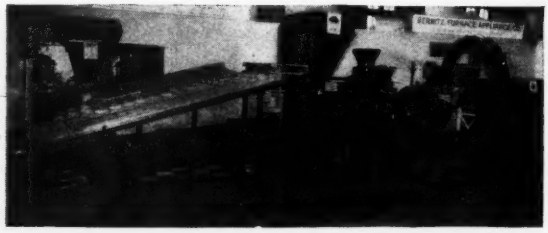
Boig & Hill, Inc., Booth 10A
180 Washington St., New York

A complete line of Curtis steam specialties made by the Julian d'Este Co. of Boston, will be shown here, with the new type Curtis return steam trap as a special feature, also a new type pressure regulator for water, air or gas.

Representatives: William T. Hill, president; Joseph Meyer, secretary; I. M. Nasoff, treasurer.

Boiler Engineering Co., Booth 450
931 Federal Trust Bldg., Newark, N. J.





This exhibit will include Turner and Beco baffle walls, showing the method of installation of these walls and with data to show the effectiveness in securing efficient combustion and heat transmission. A special feature will be photographs and working drawings of installations made by the company.

Representative: J. W. Putnam, vice-president.

Bond Foundry & Machine Co., Booth 612
Manheim, Pa.

Here will be exhibited a full line of power transmitting machinery, truck casters and commercial roller bearings. The truck caster exhibit will show casters in motion and for the first time at the Exposition the company's Les-Nois steel caster, a recent development in the field. This has ball thrust bearings on the turning spindle and roller bearings on the casters, which is made of pressed steel.

Representative: M. M. Brown, in charge.

The Borden Company, Booth 540
Warren, Ohio.

In this exhibit will be demonstrated the company's complete line of Beaver easy-working die stocks, square-end pipe cutters and portable power drive. Special emphasis will be placed on the new No. 11 and 11A Beaver die stocks in one to two-inch sizes which are a radical improvement in the receding die stock construction. The exhibit will be shown in operation and the working of the machines demonstrated.

Representatives: E. Ray Bakley, advertising manager, in charge of the booth; W. J. Mitchell, New York manager; W. H. Clark, New England representative.

Boston Gear Works, Inc.,
Booths 326 to 331
Norfolk Downs, Quincy, Mass.

Standardized gears, speed reducers, chain drives, Lewellen variable speed transmissions, pulleys, hangers, couplings and other miscellaneous power transmission equipment will be shown in this display.

Representative: Henry Muller, New York manager.

Botfield Refractories Co., Booth 92
Swanson & Clymer Sts., Philadelphia, Pa.

Products here shown will be the Adamant fire brick cement, Adachrome, Adachrome fines and the Adamant gun. As a special feature, the super-refractory Adamant-Adachrome mixture will be emphasized and the use of the Adamant gun for application of plastic refractories will be demonstrated.

Representatives: A. H. Engstrom, sales manager, in charge of booth; Charles C. Phillips, manager of New York office; S C. Lott, salesman, New England and Eastern Canada; W. B. Smith, salesman, middlewest territory.

S. F. Bowser & Co., Inc., Booth 233
Fort Wayne, Ind.

The company's filtering and oil circulating equipment as well as force feed lubricators will be displayed here. Especially featured will be the Bowser oil filter for stationary plants and for industrial installations. Operation of the force feed lubricators for all classes of machinery will be demonstrated.

Representatives: L. W. Kohler, lubrication and filtration sales manager; C. J. Worden, advertising manager; E. M. May, New York district manager.

Bradley Washfountain Co., Booth 247
Milwaukee, Wis.

A 54-inch circular type of washfountain will be shown constructed of white marble tinted in green and arranged with foot control and liquid soap dispenser. A distinctly new feature is the adoption of a variety of colors in the manufacture of this company's product which will be demonstrated by placques showing the various shades which can be obtained.

Representative: A. C. Cooper, New York.

The Brown Instrument Co., Booth 51
Philadelphia, Pa.

Indicating and recording pyrometers, indicating and recording flow meters, recording thermometers and pressure gauges, duplex pressure and temperature recorders, strip chart recording thermometers, indicating resistance thermometer so sensitive as to operate when clasped in the hand, strip chart recording resistance thermometer, Brown electric carbon dioxide meters in operation, intermediate and low range manometers, forged steel manometers in various stages of construction, portable pyrometers and potentiometers, draft gages, thermocouples, protecting tubes and automatic control valves will be included in the exhibit to be found here. Special interest will be found in the large 4-ft. flow meter showing the mechanism and workings of the inductance bridge principle which will be demonstrated in operation. The wide line of service covered by the instruments will make this exhibit an excellent opportunity to study the use of meters in the plant.

Representatives: R. P. Brown, president; C. H. Kerr, general manager, G. W. Keller, sales manager; M. M. Watkins, New York district manager.

Builders Iron Foundry, Booth 28
Providence, R. I.

Products to be found in this booth, which visitors will find of special interest, will be the KS shunt meter, first shown last year, the GK diaphragm meter, a new product, and other forms of meter manufactured by the company.

Representatives: A. M. Hammond, advertising manager, in charge of booth; D. J. Purdie, New York manager; R. E. Connet, engineer; A. E. Watjen, sales engineer; W. S. Codell, Philadelphia sales department.

Bundy Steam Trap Co., Booth 8
26 Cortlandt St., New York, N. Y.

Bundy Steam Traps will be shown in this display for all services including high and low pressure return traps, lifting traps and particularly the new Bundy steam trap. This will have ground trunnion joints which eliminate the vibration at these points and will have also a roller bearing lever rod, insuring positive and smooth operation at all times.

Representatives: E. M. Stevens, general manager; W. W. Booth, New York representative; D. J. Stump, Boston representative; John F. Fulweirler, Philadelphia representative; E. Reed, Connecticut representative.

Edwin Burhorn Co., Booth A
West 5th St., Bayonne, N. J.

Working model of Burhorn cooling towers will be shown, also photograph of exhibits and the details of fower construction. The Burhorn Smaltower will be shown in operation, this being a special design of cypress.

Representatives: Edwin Burhorn; Henry A. Stover, Jr.; William Hennings; Carl Dahlquist; Charles A. Heisterkamp; Edmund Newton.

A. M. Byers Company, Booths 429, 430
235 Water St., Pittsburgh, Pa.

A special feature of this exhibit will be a puddle ball made in accordance with the company's new process, weighing 2290 lb. as compared to the usual ball made by the hand puddling process weighing 230 lb. Samples of plate and muck bar made from the company's new wrought iron

will be shown, and samples of wrought iron pipe with literature showing its advantages.

Representative: G. W. Hamill, New York district sales manager.

Andrew C. Campbell, Booth 205
Bridgeport, Conn.

Machinery for cutting metal, sheets and plates will be exhibited here in action including the No. 0 Nibbler cutting up to 3/32-in. sheets, the No. 1-A cutting up to 3/16-in. sheets, the No. 2 cutting up to ⅜-in. plates and a representative line of the company's die sets. A special feature will be a new line of die sets and the No. 3 nibbling machine operating under shop conditions.

Representatives: S. Naramore, in charge; J. Johnson; C. E. Bilton.

The Carborundum Company, Booth 22
Perth Amboy, N. J.

Refractory brick and shapes for high temperature industrial furnaces, also water gas generators, boilers, Carbofrax refractory protection for water-tube side walls for boiler furnaces, high temperature cements will be found in this space. Various types of refractory protection for water walls will make up a special feature of the exhibit, showing the latest developments in this line.

Representatives: C. E. Hawke, sales manager; S. A. Fenno, assistant sales manager, in charge of booth; J. A. King, New England representative; F. W. Miller, New York representative; J. G. Fritzinger, Pennsylvania representative.

refrigeration unit, the company's new home air conditioning unit and equipment for drying and processing of materials will be shown.

Representatives: E. T. Murphy, vice-president; A. E. Stacey, Jr., research engineer; E. T. Lyle, vice-president; D. C. Lindsay, physicist.

The R. L. Carter Co., Inc. Booth 466
Phoenix, N. Y.

At this exhibit the main features will be Carter shapers and routers of light weight to operate from any electric lamp socket and running at a speed of 18,000 r. p. m.

Representative: T. W. Wright, New York and export sales manager, in charge.

Century Electric Co., Booths 510, 511
1806 Pine St., St. Louis, Mo.

This exhibit will include motors of the following types: repulsion start induction single-phase, 3-phase squirrel cage polyphase, 3-phase double squirrel cage, 3-phase automatic start and split phase. Fans will also be shown and the main features will be the wool yarn system of lubrication used on all motors of one horsepower and smaller, giving one year's continuous operation without reoiling, also a new 75-hp. frame which covers ratings up to and including 125 hp. at 1800 r.p.m. This frame is equipped with double-row roller bearings and illustrates the lines of motors up to 200 hp. Double row ball bearings will also be shown.

Representative: Oliver S. Imes, publicity department.

speed reduction units and high-efficiency worm gearing for industrial machinery and automotive vehicles will be exhibited and demonstrated in this booth.

Representatives: F. E. Bardrof, assistant sales manager; James T. Gordon, New York representative.

Clipper Belt Lacer Co., Booth 285
Grand Rapids, Mich.

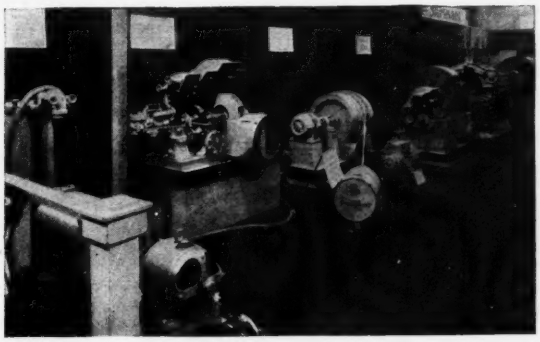
Various models of belt lacers, belt fasteners, connecting pins and belt cutters with safety feature will be shown, making up the complete line of the company's products. Under new developments will be found the Clipper speed lacer No. 6 which will lace both ends of a six-inch belt in 1½ minutes. A new ten-inch Clipper belt cutter will also be displayed and demonstrated. One special feature will be an electrically operated Clipper ship, emphasizing the name of the company.

Representative: John Jepson.

Coats Machine Tool Co., Inc., Booth 603
110 W. 40th St., New York, N. Y.

A complete line of Krupp Mikrotast gages, both internal and external for measuring to 0.00005 in. will be exhibited, also Elasticometer spring testing machine for measuring compression, elongation and load of springs, the Prestometer micrometer fluid gages used in automobile plants, Coats hand tachometers, recording indicators, laboratory stop watches and hand tachographs for giving permanent records in chart form of dynamometer tests. Divided machine vises will also be a feature.

Representative: Charles E. Coats, treasurer.



Carpenter & Paterson, Inc., Booth 529
1190 Bennington St., E. Boston, Mass.

Pipe and plumbing and heating specialties will be shown in this display, the Witch products being featured. These will include wrought iron pipe hangers and adjustable beam clamps, concrete inserts, radiator brackets, iron pipe supports, steel brackets, adjustable coil and roll hangers and roof flanges. Specially displayed will be the pipe hangers and heating specialties.

Representatives: Robert Paterson, in charge of booth; C. E. Paterson; George Paterson; William Steinmeyer.

Carrier Engineering Corp., Booth 14A
750 Frelinghuysen Ave., Newark, N. J.

Air condition equipment as applied in industrial and public buildings will be shown here, including the company's new development, the Carrier unit air conditioner. This unit has been developed in a range of sizes to give to small manufacturers the advantage of complete air conditioning without large investment. In addition a complete Carrier centrifugal

Chicago Pipethread Machine Co.,
Racine, Wis. Booth 490

Display will be made of the company's power pipe threading machines of portable and stationary type, showing especially a small portable machine equipped with all the features usually included in large stationary machines.

Representatives: Charles Rasmussen, president, engineer and designer.

Clements Mfg. Co., Booth 563
601 Fulton St., Chicago, Ill.

Clements - Cadillac portable electric blowers will be shown in three sizes, covering the company's full line, also a Clements-Cadillac hot and cold air blower and a portable gas-electric blow torch. As a special feature the gas-electric blow torch will be shown in operation, this being a new product exhibited here for the first time.

Representatives: W. J. Clements, vice-president; C. A. Bremmer.

The Cleveland Worm & Gear Co.,
Booth 93
3249 East 80th St., Cleveland, Ohio

Standardized Cleveland worm gear

The J. S. Coffin, Jr., Co., Booth 757
36 Grand Ave., Englewood, N. J.

Products to be shown will be the Coffin centrifugal pump and the Coffin feed water heater with description of new developments in these devices.

Representative: E. L. Schellens, chief engineer.

Colson New York Branch, Inc.,
7 East 19th St., N. Y. Booth 698

Casters in a complete line for all conditions will be shown here, demonstrating their adaptability for all practical service and their advantages.

Representatives: William McElraevy, in charge of booth; A. R. Gaudreau.

Combustion Publishing Corp., Booth 53
551 Fifth Ave., New York

Books of interest to those dealing with combustion problems, also current issues of Combustion will be shown here.

Representative: H. Stuart Acheson.

Connery & Company, Inc., Booth 43
2nd St., above Erie Av., Philadelphia, Pa.

Products to be shown will include Connery's improved expansion stiffener, as applied to the construction of breechings, uptakes, air and preheater ducts; Connery's improved air-cooled damper; Connery's improved expansion stack connection, and Connery's method of attachments for supporting covering. All these will be specially featured and their use in connection with the class of work manufactured by the company shown, also the use in industrial and central power stations.

Representatives: W. M. Connery; C. B. Nicholson; W. J. Henderson.

Cooper Hewitt Electric Co., Booth 49
Hoboken, N. J.

Here will be featured Cooper Hewitt industrial illumination, with a display of Cooper Hewitt Kon-nec-tors, both as used in the power field. These Kon-nec-tors are totally enclosed mercury switches in which the make and break is between pools of mercury, thus assuring long life without depreciation. Specially featured will be exhibits demonstrating utility and safety factors of this type of equipment.

Representatives: D. R. Grandy, commercial engineer; Chas. F. Strebig; J. P. O'Shea; A. W. Willmann; A. H. Kuehne; L. F. Gerisch.

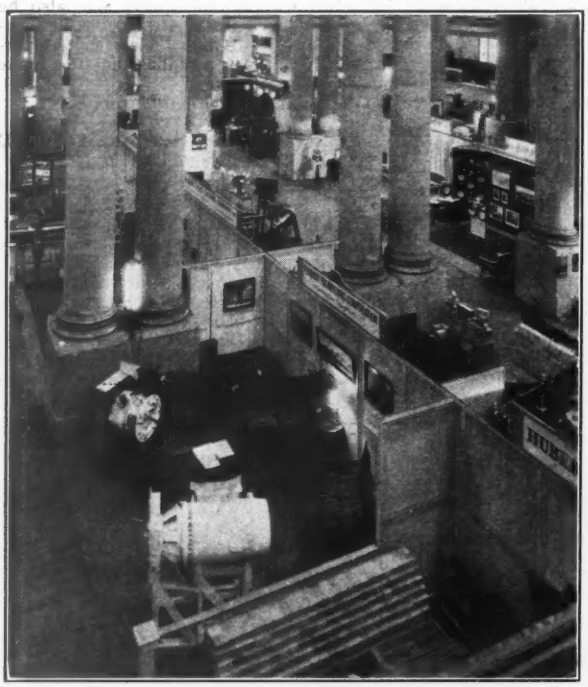
which ferrules have been entirely eliminated, as adopted by the U. S. Navy, the leading steamship companies and large central power stations. Another new product will be the Bakelite-treated metallic condenser rings.

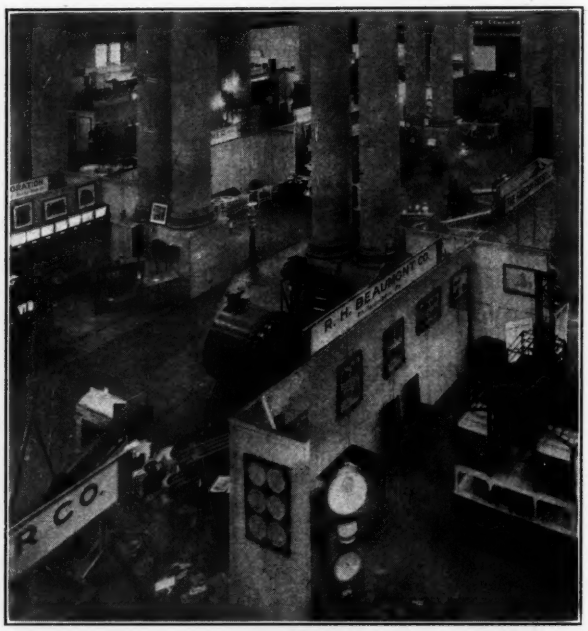
Representatives: F. E. Payne; Julian N. Walton; Newell Brackett; R. J. Brackett.

Crescent Tool Co., Booth 456
Jamestown, N. Y.

The entire line of Crescent hand tools will be shown here and their uses explained and demonstrated.

Representatives: C. R. Swisshelm, sales manager; Argus Sheridan, advertising manager; C. A. Colander; J. E. McWilliams; John W. Hartley; H. A. Knight.





The Consolidation Coal Co. Booth 433
15 Broad Street, New York, N. Y.

Products to be shown will be samples of coal from the company's various operating divisions.

Representative: J. M. Dougherty, advertising manager.

Consolidated Gas Company of N. Y. Booth 7
130 East 15th St., New York, N. Y.

Heat and coal for industry with complete lines of refrigerators, building heating and water heating equipment, also industrial applications of gas for production purposes will be displayed, the units being in operation or capable of operation where practicable.

Representatives: G. H. Stang, sales manager, Brooklyn Borough Gas Co. T. B. J. Merkt, sales promotion department; R. H. Staniford, Jr., assistant to manager, industrial division; J. F. Quinn, industrial sales supervisor; Brooklyn Union Gas Co. C. E. Muehlberg, manager, A. P. Schmidt, assistant manager, industrial division; A. A. Pihlman, supervisor, water heating and house heating division; Consolidated Gas Co. F. D. Grafton, heating engineer, Kings County Lighting Co. J. F. Reeder, manager, industrial division, New York & Richmond Gas Co.

Charles Cory & Son, Inc., Booth 431
183 Varick St., New York

Signal and communicating systems will make up the exhibit to be found here. This will include Cory-Robinson Interloks, seamless flexible metal hose, Cory signal systems, Antinoise telephones, and a full line of signaling, communicating and lighting equipment. Signal systems will be shown in operation and will constitute a main and interesting feature of the exhibit.

Representatives: L. E. Oneal, sales manager; A. D. Blanchard.

Crane Packing Company, Booths 478, 479
1800 Cuyler Ave., Chicago, Ill.

Metallic and semi-metallic packings made of babbitt, aluminum and copper will be displayed, suitable for saturated steam, superheated steam, hot oil, hot and cold water, ammonia and carbon dioxide. Metallic condenser packing and metallic evaporator packing, made up of endless rings of babbitt and aluminum, will also be shown and, as a special feature, a model condenser showing the inlet ends of tubes expanded and rolled into lead slugged fibres with the outlet ends packed with metallic packing without ferrules. This is a new process in

Crocker-Wheeler Electric Manufacturing Co., Inc., Booth 17
Ampere, New Jersey

In this exhibit will be found the following new equipment: the noiseless Garrard gear, a speed reducer or speed increaser; a new across-the-line induction motor; four lines of new ball-bearing motors, two for direct current and two for alternating current. A special feature will be the company's Navy type 500 cycle, single phase, wind driven generator as used on aeroplanes to furnish power for radio transmission.

Representative: W. K. Brown, eastern sales manager.

The Cutler-Hammer Mfg. Co., Booths 261, 262
12th & St. Paul Ave., Milwaukee, Wis.

Here will be found a variety of apparatus consisting of motor control, across-the-line automatic starters, motor-operated valve control, the new C-H unbreakable resistor, the AAA small size across-the-line automatic starters and various other equipment. One of the outstanding features will be the unbreakable grid resistor, designed and built for steel mill duty. This is of continuous strip with a steel supporting frame and adjustable connectors, the insulation being all mica. It is designed to give free

ventilation and has large surface for the low resistance taps.

Representatives: F. U. Webster, advertising manager; C. W. Yerger, New York district manager; A. T. Calvert, New York representative.

The Dampney Co. of America, Booth 62
Hyde Park, Boston, Mass.

Complete line of Apexior protective coatings for metal surfaces will be shown and the result of the use of these coatings in the protection of boiler, economizer and condenser tubes. A number of samples of tubes that have been pickled for removal of mill scale and later covered with Apexior coating will show the condition of the coating after various lengths of service under operating conditions.

Representatives: E. F. Gilbert, president; C. F. Moore, J. S. Cheverie, C. Pope, Boston; T. H. Burch, Jr., New York; C. J. Hunter, Philadelphia.

M. T. Davidson Co., Booths 36, 37
154 Nassau St., New York, N. Y.

Davidson simplex steam pumps and motor-driven centrifugal pumps will be shown, also sump pumps for drainage system.

Representatives: John Lowe, vice-president and secretary; William E. Brennan; Thomas J. Rogers; L. K. Stevens; G. W. Bantel; H. A. Schreiber.

Dearborn Chemical Co., Booth 13
310 So. Michigan Ave., Chicago.

Samples will be displayed of water-treating preparations, of lubricating oils, of No-Ox-Id, rust preventive and of Dearborn powdered cleaners. These products will be the very latest developments of the company in various lines and the results obtained from their use as well as the method of using, will be fully demonstrated.

Representatives: Grant W. Spear, vice-president and eastern manager; W. H. Kinney, eastern sales manager; C. A. Remsen, eastern manager, department of specialties; Messrs. Platt, Carr, Harris, Tibbetts, Opdyke and Spence.

Dennis Engineering Co., Booth 771
243 No. High St., Columbus, O.

Dennis expansion joints and the L-R soot blower will be shown here, both of them new products in the power plant field. As a special feature, the exhibit will have full size equipment of both lines to show, for the soot blower, the convenience, long reach and effective method of blowing the tube and, for the expansion joint, the unique construction for connecting the turbine outlet to the condenser nozzle.

Representatives: B. W. Dennis; L. R. Lickert.

Julian d'Este Company, Booth 10
Cambridge & Spice Sts., Boston, Mass.

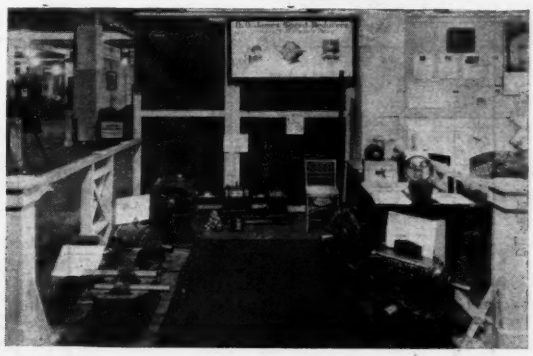
For the first time this company's new Curtis type T return trap will be shown, embodying new and simple design in this form of trap to secure compactness and freedom from trunnions, weights, projections or oscillating parts. All valve movements are controlled externally at one point and all moving parts are outside and accessible, no parts being inside but the float and float stem. Complete line of Curtis engineering specialties will also be shown, including pressure reducing valves, steam traps and damper regulators.

Representatives: William T. Hill; Joseph Meyer; George Bezanson; W. A. Viets; William Manson; D. A. Herrick.

Detroit Lubricator Company, Booth 533
40 W. 40th St., New York, N. Y.

This exhibit will include a comprehensive line of oil burner devices, such as fuel pumps, pressure regulating devices, metering valves, float valves, strainers, gravity control assemblies, safety shut-off valves and the full line of Detroit heating specialties and power plant apparatus.

Representative: P. S. Russel.



Joseph Dixon Crucible Co., Booth 254
Jersey City, N. J.

Graphite products of the company, including lubricating flake graphite, belt dressing, pipe joint compound, graphite seal, graphite greases and silica-graphite paint, will be found here. Uses of these products will be demonstrated and full descriptive matter will be available to show the importance of graphite both as a preservative and as a lubricant.

Representative: E. S. Clauch, in charge.

D. T. Dobyns, Booth 46
21 Park Row, New York.

Huber stokers with photographs and records of performance as installed and operating in and about New York City will be shown and demonstrated here to illustrate the performance of the stoker from a local standpoint.

Representative: D. T. Dobyns.

Doehler Die Casting Co., Booth 609
272 Lafayette St., New York, N. Y.

Doehler die cast stock gears and Bond cut standard stock gears will be shown here. The exhibit will include an attractive moving display of different types and sizes of the die cast gears, showing many of the special and intricate forms which can be made with cut teeth. High ratios of reduction by the use of different types of stock gears will be demonstrated, including spurs, bevels, spirals and single and multiple threaded worms. Carrying die cast gears in stock is a new departure from which comparatively small users will obtain an advantage.

Representatives: H. D. Stanley, manager gear division; C. Lombard; W. R. Milnor, Philadelphia.

Domestic Stoker Co., Booths 217, 218
7 Dey St., New York.

The Electric Furnace-Man Stoker, Models H2R and M will be exhibited, also the double burner pot model of the Electric Furnace-Man in model K. An interesting feature will be the H2R model in actual operation under fire, illustrating the ease of operation and the effectiveness of action. A new feature will be the Model M, a single burner type stoker with a capacity between that of the other models.

Representatives: C. H. Hall, chief engineer; Oscar F. Ostby, assistant to the president; F. G. Ruppel, in charge of booth; Robert Gevrenz; Fred Hilder; I. C. Elmer.

Dot Lubricating Equip. Co., Booth 744
31 Ames St., Cambridge, Mass.

This company will show Dot lubricating products, including a line of industrial devices for application of lubricants to bearings or machinery in power plants and factories. This line includes Dot guns and nipples, pressure cups, hand and foot-operated grease pumps, power pumps, group lubrication systems and the special lubricant that the company makes for use with this system. Special attention will be given to Dot-O-Matic pressure cups whose delivery is adjustable so that the contents will be fed at a uniform rate during a period of one to fifteen days, thus eliminating frequent application of lubricant. A new feature will be the electric lubricator, a self-contained, motor-driven unit with a capacity of 20 lb. of grease or oil, having control of the tank and motor centered at the nozzle. This is a portable tank, making automatice lubrication available for the small user of machinery.

Representatives: C. L. Hall, New York manager; A. W. Smith, W. E. Williams, factory representatives; P. K. Niven, sales promotion.

A. W. Dovel Co., Inc., Booth 699
309 Atlantic Ave., Brooklyn, N. Y.

Enterprise rotary fuel oil burners will be found in this exhibit, the main features being domestic and industrial equipment of this device with the details fully demonstrated.

Representatives: A. W. Dovel, president; Stevel L. Ochoa, sales manager.

C. A. Dunham Co., Booths 235, 236
450 East Ohio St., Chicago, Ill.

Here will be shown the company's products, including Dunham differential vacuum heating system operating units and the equipment which goes to make up this system.

Representatives: C. A. Thinn, chief engineer; L. Nichols, factory representative.

Durabla Manufacturing Co., Booth 296
114 Liberty St., New York, N. Y.

Durabla products will be shown, including metal pump valve units, homogeneous fibre asbestos sheet and gaskets, semi-metallic rod packing, high-pressure gage glasses and gage glass washers, high-pressure discs.

Representative: G. F. Marriott, district sales manager.

The Duriron Company, Inc., Booth 6
Dayton, Ohio.

coal from the Fairmont mines, including the Delmar 1 and 4, Ruth, Helen, Barry, Robert, and Clauson, will be shown in this booth and the qualities of the various coals explained.

Representative: J. F. Whelan, New York resident manager, in charge.

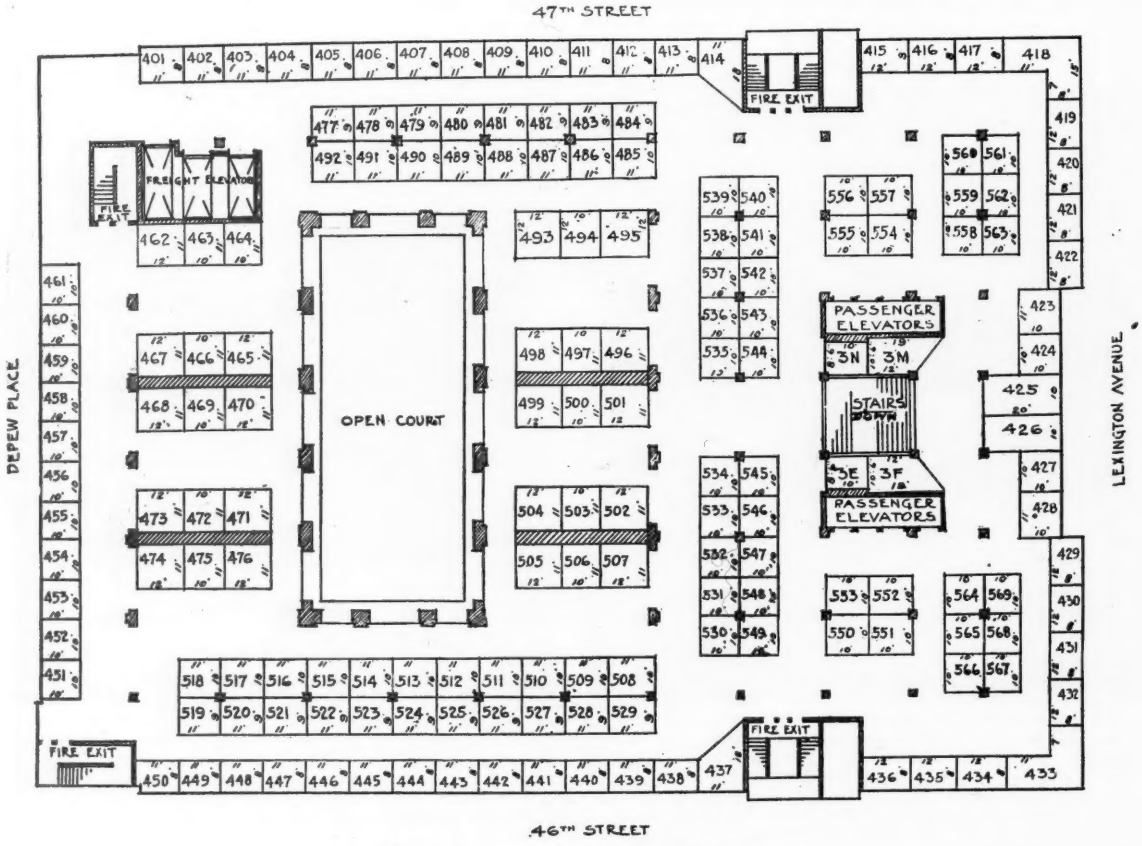
The Electric Controller & Mfg. Co.,
50 Church St., N. Y. Booths 766, 767

Control equipment, including the following will be shown: automatic synchronous motor control, automatic induction motor control, automatic slip-ring motor control, manual crane controllers, brakes, automatic pump and air compressor control and magnetic separators. One special feature will be a Unitype synchronous motor starter in a completely enclosed, self-contained design to provide entirely automatic starting. Another special feature will be an automatic power factor regulator which will hold the power factor on a motor or on a system at a determined figure. Cast iron enclosures of the controllers, particularly suitable for use in chemical mills, cement plants and other locations where dirt, corrosion or explosion hazards are encountered, will be especially emphasized in the exhibit.

Representatives: W. R. Yorkey, district manager; W. S. Gain; F. L. Jones; H. A. Philip; J. D. Brick.

power factor correction, with a demonstration unit showing why a capacitor is used. This unit will consist of an induction motor driving a load to which can be switched a capacitor. A demonstration test, showing the operation of the E-M constant frequency relay starter for synchronous motors will consist of a standard full voltage automatic starter connected to a small synchronous motor. Demonstrations of an educational nature will be the main feature of the booth, showing the operation of synchronous motor starters and the use of the capacitor for power factor correction. The capacitor embodies a new type of construction, in which the entire corrective kv-a. is enclosed in an oil-filled, welded steel tank.

Representatives: E. H. Pearson, New York City sales manager; C. R. Zimmerschied, New York sales engineer.



THIRD FLOOR BOOTHS RUN FROM NO. 401 TO 569

In this exhibit will be included acid-resisting valves, fittings, pipe, pumps, exhaust fans and the like. A cascade arrangement will be shown with weak nitric acid trickling over Duriron, lead, cast iron, wrought iron and steel, to show the effect which even weak acid exerts on different materials.

Representatives: E. A. Suverkrop; P. C. Lewis; E. D. Brauns; H. R. Daniels; M. W. Smith.

Durametallic Corporation, Booth 408
806 Cobb Ave., Kalamazoo, Mich.

Durametallic flexible metallic packing will be shown here in all types and for all purposes, including rod packing and gaskets; also bearing metals.

Representatives: Charles C. Hall; J. J. McQuillen; Herbert Lewis.

Eastern Fuel Company, Booth 251
Pittsburgh, Pa.

Coal from the company's Sonny mine located at Lonaconing, Maryland, also

Electric Machinery Mfg. Co., Booth 337
Minneapolis, Minn.

An interesting feature here will be a 440-volt, 120 kv-a. E-M capacitor for

Electro-Magnetic Tool Co., Booth 473
5 Great Jones St., New York, N. Y.

Electric saws, hammers, drills and combination tools will make up the display of this company. Particularly featured will be the combination SpeedWay portable electric drill and saw kits, also the Speed-Way Shops, these outfits being designed for easy transportation and to be a complete outfit for the handling of small work of all kinds.

Representative: F. L. Heath.

Ellison Draft Gage Co., Booths 81, 82
214 W. Kinzie St., Chicago.

Products shown here will include Ellison draft gages, in tube and pointer types,

also the Ellison steam calorimeter and Pitot tubes. New products which will be found of special interest are the mercury elements in the pointer draft gages for high readings and the special mounting of gages for combination work.

Representatives: Lewis M. Ellison; H. S. Stockdale; Charles C. Phelps.

The Engineer Company, Booth 18
17 Battery Place, New York, N. Y.

Oil burning equipment and combustion control equipment will be the display in this booth, the construction and operation of the equipment being fully shown.

Representative: A. W. Patterson, Jr., vice-president.

Engineering Products Corp., Inc., Booth 752
25 Church St., New York, N. Y.

Epco protective hoods and respirators designed for the protection of employes in all classes of dust and vapor-carrying atmospheres will be demonstrated here.

Another feature will be a recently developed Warner collapsible flag and lantern stand. The Epco safety saw for use on live primary cable work and in cramped spaces near live electrical conductors, will also be shown.

Representative: S. D. Sprong, president.

Engineers Book Shop, Booth 28B
159 E. 48th St., N. Y.

An exhibit of technical books, government reports and data will be shown here illustrating the book shop service to engineers and manufacturers.

Representatives: E. Harder, in charge of booth, A. Knatz.

Erie City Iron Works, Booth 91
Erie, Pa.

In this space, the visitor will find exhibited, a three-drum boiler, an integral economizer, a Seymour furnace, a Vortex furnace and a Unitype pulverizer to illustrate the products that the company manufactures. As a special feature will be found the Seymour-Carbofrax furnace, the lining of which is of Carbofrax, the silicon carbide refractory manufactured by the Carborundum Co., and is water cooled. Figures will be shown to demonstrate that capacities and load ranges from the operation of this furnace with the three-drum boiler, fired with pulverized coal, indicate a distinct advance in the art of steam generation.

Representatives: G. D. Selden, sales promotion manager in charge of booth; Hays Clemens, president; L. V. Reese, general manager; J. R. Edwards, sales manager; E. R. Cate, chief engineer; F. Brinig, assistant sales manager.

Erie Malleable Iron Co., Booth 523
Erie, Pa.

Kondu fittings, connectors and couplings will be displayed by this company, the fittings being threadless pipe fittings for electrical conduit work. They are made of certified malleable iron, unbreakable, and eliminate the threading of conduit for the use of union fittings. Kondu knockout box connectors and couplings are designed to take the place of locknuts, bushings and threaded couplings in new building construction, while Kondu fibre-to-iron couplings solve satisfactorily the problem of joining fibre and iron conduits.

Representatives: E. J. Hunter, New York district manager, in charge of booth; F. H. Jennings; T. F. Horan; R. E. Peoples.

Everlasting Valve Company, Booth 52
1 Exchange Place, Jersey City, N. J.

Everlasting products will be shown in this exhibit including the regular blowoff valve, companion angle valve, duplex blowoff unit for pressures up to and including 500 lb., companion angle twin blowoff unit for pressures up to 600 lb., special water column valve, Flatplug valve and new improved disc spring for the regular Everlasting valve. Special features which will be found at the exhibit will be the Everlasting's companion angle valve, the Everlasting duplex blowoff unit and the new improved disc spring.

Representatives: John H. Allen, president; E. N. Corning, sales engineer; S. E. Carman, sales representative; George M. Elton, in charge of exhibit.

Fabreeka Belting Company, Booth 480
461 Eighth Ave., New York, N. Y.

Fabreeka belting with a fine leaf of fabric constructed into the belt so that it has minimum stretch and maximum strength, will be shown. Ability of the edge of the belting to stand the pressure of shifters will also be demonstrated.

Representatives: Sidney N. McNaught; Gustave Gorden Schick; J. R. Lambert.

The Fafnir Bearing Company, Booth 246
New Britain, Conn.

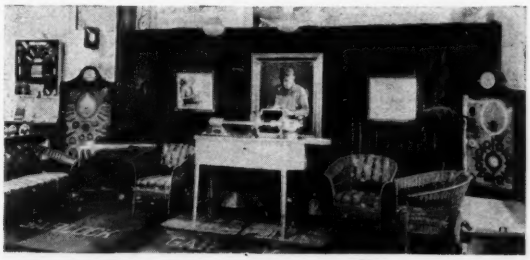
This company will show a complete line of standard ball bearings, including the single row radial, single row radial thrust, double row thrust; also a complete line of ball bearing power transmission equipment including hanger boxes, pillow blocks, blower boxes and loose pulleys. The last named all use Fafnir wide inner ring bearings with a simple mounting which has no sleeves, adapters or adjustments on any straight shaft. Special features of the exhibit will include a stand with eight shafts and sixteen ball bearings driven by a 1/40-hp. motor, a General Electric motor equipped with ball bearings cut away to show the mountings, also a ball bearing speed reducer.

Representatives: M. Stanley, president; E. R. Carter, vice-president; R. N. Hemenway, vice-president; S. M. Cooper, advertising manager in charge of the booth; C. F. Stanley, assistant secretary; H. R. Reynolds, chief engineer; R. Reilly, sales engineer, New York territory; George Barenborg, manager Newark office; D. J. Gilbert, New England territory.

The Falk Corporation, Booth 77
Milwaukee, Wis.

Herringbone gears, herringbone speed reducers and flexible couplings will make up the exhibit of this company. Main features to be shown will be a flexible coupling operating under load to demonstrate ability to accommodate misalinement, to permit free end float and to absorb shocks.

Representatives: H. S. Falk, vice-president and works manager; P. C. Day, chief engineer; M. A. Carpenter, manager commercial sales; Mason Hulett, E. A. LeMay, New York office; F. A. Stahl, Albany office.



Farnsworth Company, Booth 409
Conshohocken, Pa.

Special condensate pumping equipment, paper drying system, oil and steam separators, feedwater heater and various heat reclaiming systems and methods will be shown.

Representatives: F. C. Farnsworth, president; George Onfrey, designing engineer; P. M. Crockett; H. Raub.

Fisher Publishing Co., Booth 625
95 King St., East, Toronto, Can.

Here will be shown Power Age and also Fisher's Machinery Guide. The growth of Canadian industries during the last decade will be illustrated.

Representative: C. J. Nuttall, eastern manager.

Fitzgibbons Boiler Co., Booths 662, 663
570 Seventh Ave., New York, N. Y.

Boilers for low-pressure heating work and for high pressure up to 160-lb. working pressure will be shown in a complete line.

Representatives: G. E. Olsen; Raymond Newcomb, assistant manager of sales.

Foley Saw Tool Co., Inc., Booth 451
9 N. E. Main St., Minneapolis, Minn.

Foley automatic saw filers and automatic saw grinders will be shown in this booth, a special feature being demonstrations of filing hand, band and circular saws, also automatic grinding of high-speed hack saw blades and metal-cutting band saws. This will show the possible salvage of such hack saw blades and the increased cutting production from such blades and from the band saws after grinding with the company's devices. An entirely new product will be the automatic saw grinders demonstrated in operation as already mentioned.

Representatives: Walter M. Ringer; Purdom Carpenter; Vincent Mathieu; Glenn Steen.

O. E. Frank Heater & Engineering Co., 20 Milburn St., Buffalo, N. Y. Booth 52

OEF oil coolers and heat exchangers will be exhibited and demonstrated, this being a new patented design with permanent pipe connections and test ring. Shell and liquid channel box are cast integral so that the tube bundle may be removed without breaking pipe connections or ports, or, if it is desired to clean the unit or replace a tube, that can be done without removing the tube bundle. This is a new design of equipment and should be of especial interest to visitors.

Representatives: Mrs. O. E. Frank, president; H. P Wilder, vice president; P. L. Rhodes, manager New York office.

Fredericksen Company, Booth 519 Saginaw, Mich.

This company will exhibit ingots, castings and finished bushings and bearings made from its bearing metal, Sabeco Bearing Bronze.

Representatives: Arthur A. Schupp, general manager; Karl A. Agricola, factory representative; Henry Limbach, sales manager; C. D. Proctor, New York representative; Ralph Sherry, Chicago representative.

The Foundation Company, Booth 21 120 Liberty St., New York, N. Y.

Power plant construction will be shown pictorially here and the work that the company does in the erection of power plants will be fully illustrated.

Representative: Colonel F. W. Lewis, in charge of exhibits.

Fuel Oil, Booth 696 420 Madison Ave., New York.

In this display will be found the publication, Fuel Oil and Temperature Journal, which covers the field that its name indicates.

Representative: C. A. Ott, business manager.

J. H. Furrer & Co., Inc., Booth 664 375 Sherman St., L. I. City, N. Y.

Boiler compound for high and low-pressure boilers, water treatments for hot water heating systems, superior leather belt preservers and belt dressing for rubber and canvas beltings will make up the display in this booth.

Representatives: J. J. Furrer; J. H. Hart.

Fyre-Freez Corporation, Booth 245 17 West 46th St., New York.

Fyre-Freez carbon dioxide extinguishers in portable and stationary form will be displayed in this booth.

Representatives: Alex. McKinney, industrial sales department; G. M. Marr; David Leerburger.

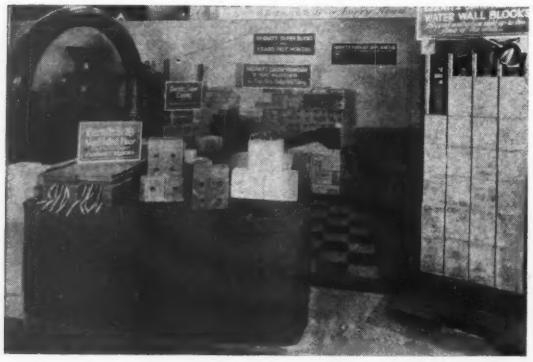
G & G Atlas Systems, Inc., Booths 86, 87, 88 537 W. Broadway, New York, N. Y.

Pneumatic dispatch tubes for retail stores, hotels, banks, factories and other buildings for transmitting written documents and small parts among scattered departments will be shown here. A complete miniature system will be in operation showing various size tubes.

Representatives: Charles E. Prout, advertising manager; William H. Dinspel, New York; Fred W. Gillette, Chicago.

The Garlock Packing Co., Booths 545, 546 Palmyra, N. Y.

Products shown will be a full line of the Garlock mechanical packings made from asbestos, rubber, fibre and metal in all kinds and types and for all uses. Various uses of sheet, coil and gasket packings will be demonstrated and the construction shown.



Representatives: P. D. Miller, manager of New York district sales office; F. P. Morton, C. D. Castle, J. J. McLaughlin, R. H. Reyelt, Joseph Yamin, J. M. Drinkwater, C. R. McAfee, H. J. Garlock, Isaac McAllister, sales representatives.

General Insulating & Mfg. Co., Booth 565 Alexandria, Ind.

This company will have its complete line of Gimco products on exhibit, including 20 styles of high-temperature Rock Wool Flexfelt, 10 styles of Rock Wool pipe covering, high-temperature insulating block, insulating cements, insulating brick, loose and granulated Rock Wool, cold storage Flexfelt and pipe covering, Rock Wool corkboard and granulated cork. Special features will be Flexfelt attached to sheet metal for duct covering work and a miniature annealing oven door insulated with Rock Wool Flexfelt. Displays of pipe covering, including high-temperature Rock Wool applied to pipe for superheated and saturated steam, and a second display for all kinds of cold storage, brine lines, ammonia lines and cold water pipes, will be shown.

Representative: G. S. Jones, sales manager.

General Stoker Corp., Booths 230, 231 270 Lafayette St., New York, N. Y.

Two complete underfeed stoker assemblies will be displayed, the special features being the silent gear drive, enclosed motors and adaptability to wide range of Fuels through positive zoning of the air supply.

Representative: M. W. Crew, president, in charge.

Gillis & Geoghegan, Booths 86, 87, 88 537 W. Broadway, New York, N. Y.

Telescopic hoists for ash removal, safety devices for guarding sidewalk openings, also means for electrically and manually operating the telescopic hoists and controlling the sidewalk guards will be displayed in this booth.

Representatives: Charles E. Prout, advertising manager; William H. Staples. J. J. O'Connell, J. F. Shiel, New York; Fred W. Gillette, Chicago.

Girtanner Engineering Corp., Booth 207 122 Greenwich St., New York, N. Y.

Pipe line systems for handling ashes and other granular material will be shown in four distinct types known as steam jet, steam vacuum, pneumatic and hydraulic systems. This constitutes a complete line of this apparatus. As a special feature, a line of furnace and ash pit doors will be demonstrated, designed particularly for heavy duty and high temperature work. The operation of the conveying system will be shown in action.

Representatives: Alexander Girtanner; J. J. McNulta.

Grinnell Company, Booths 308 to 311 Providence, R. I.

Included in this exhibit will be Grinnell fabricated piping, pipe bends, lap joints, pipe hangers, three sizes of Thermoliers, Equiflo valves, Lux fire extinguishing equipment and other products of the company.

Representatives: J. D. Pryor, vice-president; A. W. Moulder, manager, heating and power division; John B. Coleman, chief engineer; J. C. Hartwell, department manager, heating and power division; L. M. Brightman, supply department manager; Russell Bontecou, sales manager, supply division; Howard E. Branch, publicity and promotion department; Providence, R. I. E. J. Morris, sales engineer; R. F. Gardner, Jr., supply department manager; New York N. Y. H. P. Conway, southern district manager; Saxby Chaplin, department manager, heating and power division; Charlotte, N. C. H. F. Coleman, engineer, heating and power division, Atlanta, Georgia. W. C. Barnes, eastern district manager, Philadelphia, Pa. F. M. Daugherty, central district manager, heating and supply division, Warren, Ohio. C. W. Little, sales engineer, Detroit, Michigan.

Gun-fil Corporation, Booths 413, 414 112 S. 16th St., Philadelphia, Pa.

Gun-fil lubricators, lubricating systems and accessories and the methods by which they operate will be demonstrated in this space.

Representative: D. R. Weber, sales department.

Hansen & Yorke Co., Inc., Booths 513, 514 88 Warren St., New York, N. Y.

Here will be found Sumet bearing metal, Barnes high speed red arrow hack

saw blades and Van Dorn electric drills.
Representative: J. C. Hansen.

Hardinge Company, Booth 60
York, Pa.

Working models will be shown of the Hardinge Conical Ball Mill unit coal pulverizer, the Hardinge clarifier and the Ruggle-Coles Dryer. Especially interesting will be a scene-in-action picture illustrating the operation of the Hardinge system of grinding and air separating. Another special feature to be seen will be the unit coal pulverizer, demonstrating the method of operation and showing the construction of the device.

Representatives: W. H. Withington, in charge of booth; H. W. Hardinge, president; Harlow Hardinge, vice-president; F. E. Finch, secretary and sales manager; Messrs. Sancton, Bamman, Metz, Towers, Fleming, Ankeny, Dolan.

A. J. Hemphill Co., Inc., Booth 612
233 Centre St., New York, N. Y.

Truck casters, power transmitting machinery and belting will make up the exhibit in this space, the special feature being a movable caster exhibit to demonstrate the value of the company's products. A new Les-Nois truck caster will be demonstrated.

Representatives: M. M. Brown; Elmer S. Cook; R. T. Onley; E. Farley.

Hendrick Manufacturing Co., Booth 422
Carbondale, Pa.

Perforated metal screens, Mitco interlocked steel grating, Mitco Shur-Site stair treads and elevator buckets will be the products displayed and demonstrated in this space. Special features to be emphasized will be the perforated metal screens and the interlocked steel grating.

Representative: B. G. Dann, manager New York office.

E. Vernon Hill Company, Booth 2E
121 No. Clark St., Chicago, Ill.

Air testing instruments will make up this display including draft gages, anemometers, Pitot tubes, wet and dry thermometers, dust counters and the like. The company will also display the Aerologist, a publication devoted to controlled ventilation. Actual operation of all instruments will be demonstrated in typical performance, including the latest design in wet and dry bulb thermometers, which are new at this display.

Representatives: Dr. E. V. Hill, president; P. J. Marschall; E. B. Stark.

The Hisey-Wolf Machine Co.,
Cincinnati, Ohio. Booths 233, 234

This company's popular sizes of electric drills, screw drivers, electric grinders and electric buffing machines will be shown and their operation demonstrated.

Representatives: H. W. Wallace; W. J. Freidlander.

Hoffman Specialty Co., Inc.,
Booths 437, 438
25 West 45th St., New York, N. Y.

Educational films will be shown by means of a continuous motion picture apparatus with demonstration of venting of heating systems. A working exhibit will also be made of the Hoffman differential loop working under steam as in regular installations. Other products to be shown will be the Hoffman No. 1 air valve, No. 2 air and vacuum valve; No. 7 modulating inlet valve, No. 8, L8 and 9 thermostatic traps, blast traps, differential loop and other equipment for steam and vapor heating.

Representative: P. D. Rech, in charge of booth.

The Hollow Center Packing Co.,
6523 Euclid Ave., Cleveland, O. Booth 772

The company's products under the trade name Ovalhole will make up the exhibit in this booth, including five different styles of the Hollow Center packing. These will be the regular packing for steam pressures up to 125 lb., for ammonia service and for plungers on outside or center-packed pumps handling hot water; the high-pressure packing for pressures between 125 and 160 lb.; braided asbestos packing for superheated steam and pressures above 160 lb.; red hydraulic packing for pistons of inside hot water boiler feed pumps and for all hydraulic services where the square white duck packing has formerly been used. A special feature of the exhibit will be a new line of metallic and semi-metallic packings, embodying the principles of the oval hollow center.

Representative: Ernest H. Smith, president.

Howell Electric Motors Co. Booth 715
Howell, Michigan.

An operating exhibit with two motors periodically dipping into a tank of water to demonstrate the high insulating properties of Howell Red Band motors against moisture will be shown in this space. There will also be shown a new condenser type single-phase motor, having no commutator or brushes, and with the characteristics of high power factor and efficiency, low running current, quiet operation, ruggedenss and dependability. Another feature will be the Type K enclosed fan-cooled squirrel cage motor for locations where dust, dirt, moisture or gases are to be found, also a squirrel cage motor with Timken roller bearings, having the bracket and bearing cut away to show the Howell automatic bearing adjuster.

Representative: Fred K. Stone, New York office.

Jerome W. Hurych Mfg. Co., Booth 756
2431 Kindred St., Astoria, L. I., N. Y.

The company's latest model of automatic drafting table will be shown in operation and its advantages explained.

Representative: Mr. Hylsky.

Hydro-Centrifugals, Inc., Booths 526, 527
33 Rector St., Bowling Green, N. Y.

In this space will be displayed the Viersen Centrifugals Schaefer Skein Shaker.

Representative: William Zur Welle.

Ideal Lubricator Company, Booth 336
2120 Packard Bldg., Phila., Pa.

Ideal system of lubrication and distribution will be shown here in action with photographs of representative installations. This is a constant pressure grease lubricator system with central distributor and regulating valves for individual bearings, so designed that the pressure on the grease remains constant at all times. This gives constant flow as gaged by the regulating valve and allows of supply of lubricant at one central point, thus avoiding the chance of overlooking bearings in refilling.

Representatives: Y. V. Carpenter, vice president; William Culp.

Illinois Engineering Co., Booth 23
Racine Ave. & 21st St., Chicago, Ill.

Vapor and vacuum heating equipment will be displayed in this space and as a special feature a glass working model of the company's Eclipse steam trap operating under actual service conditions to show construction and the sequence of operations. The Illinois Zone heat control with master valves in operation by distant thermostats, cut out sections of reducing valves of various types, back pressure valves and a complete line of Illinois heating system specialties will also be shown.

Representatives: James C. Matchett, vice president; J. L. Ehretsman, Chicago office, in charge of booth; A. L. Browne, Herbert Fox, A. Bittner, New York representatives; Paul B. Huyette, New York representative; W. I. Collier, Baltimore; C. W. Sisson, Boston; I. H. Geiger, Harrisburg, Pa.

Imperial Coal Corporation, Booth 35
342 Madison Ave., New York.

Coal in various forms will be shown here as marketed by the company and a standardized bituminous coal will be the special feature of the exhibit.

Representative: George E. Owen, fuel engineer.

International Nickel Co., Booth 9
67 Wall St., New York, N. Y.

Monel metal, rolled nickel and the company's new nickel-cast-iron alloys will be shown here. Display will also be made of the use of monel metal for special parts in all kinds of power plant apparatus.

Representative: L. Muller-Thym, in charge of booth.

I-T-E Circuit Breaker Co., Booth 44B
19th & Hamilton Sts., Philadelphia, Pa.

I-T-E circuit breakers and U-Re-Lites will be shown in all types and sizes. As a special feature a 1000-ampere, full automatic, double-throw transfer switch for insuring power and light supply for hospitals and theatres will be exhibited. This automatically changes the circuit from normal to emergency and returns to normal when normal service is restored. Another feature will be a 2000-ampere generator breaker with direct-acting field discharge clips. New equipment which will be on display will be the new U-Re-Lite all-steel distribution groups, circuit breakers and buses, totally enclosed in steel and the remote control U-Re-Lites.

Representatives: E. Swift Newton, vice president; P. C. Gunion, sales manager; M. B. Cutting, R. C. Heyl, Warren Jessup, T. J. Ashe, Jr., New York representatives.

Johnson Service Company,
Milwaukee, Wis. Booths 541, 542

Automatic temperature regulation specialties will make up the exhibit here with the Johnson dual system of temperature regulation as a special feature. Included will be regulation of temperature and humidity for buildings and industrial plants, thermostats for refrigeration, cold storage and other industrial purposes and electric thermostats for controlling refrigerator motors and heaters. Working of the systems will be demonstrated in operation.

Representatives: P. A. Riccio, sales engineer, in charge of booth; Frank P. Brophy; John B. Hashagen.

W. A. Jones F'd'y & Mach. Co.,
Booth 19
4401 W. Roosevelt Road, Chicago, Ill.

Spur gear speed reducers, worm gear speed reducers and reducers of the Herringbone gear type will be exhibitd and their operation fully demonstrated.

Representative: R. B. Moir, manager, New York office.

Justus Steam Trap Co., Booth 255
Napanoch, N. Y.

Products shown here will include the Justus steam trap in various models and a special feature will be a new and im-

proved Ballancer, illustrating the method of operation.

Representatives: H. W. Justus; Mr. Norden and Mr. Bauer.

The E. F. Keating Pipe Bending and Supply Co., Booths 229, 230
Hartford, Conn.

Reënforced, square-corner, Van Stone joints made from genuine wrought iron and steel pipe will be shown, also samples of large pipe bends, of welded headers, of special coils and of high pressure piping.

Representative: M. Readey, manager of sales.

Keller Mechanical Engineering Corp., Booth 518
70 Washington St., Brooklyn, N. Y.

The Kellerflex flexible shaft machine will be shown in six different types, the main feature of the exhibit being an adjustable flexible shaft, which is a new feature in the equipment of flexible shaft machines.

Representatives: H. P. Loewenberg, sales engineer; Henry Schreiber, engineer.

Kennedy-Van Saun Mfg. & Eng. Corp., Booths 208, 209
2 Park Ave., New York, N. Y.

In this exhibit the main feature will be a scene-in-action machine, portraying a picture of pulverized coal equipment firing a steam boiler. There will also be a gyratory crusher in action portrayed by the same type of machine. Other features of the exhibit will be photo-posters, showing plants in which the company's pulverized coal equipment is installed; also drawings and literature on this subject.

Representatives: J. E. Kennedy, president; R. M. Kennedy, secretary; A. W. Hamilton, treasurer; H. W. Johnson, chief engineer; Guy D. Leopold, in charge of exhibit; J. A. Lodwick, J. V. Pyle, A. Gruenwald, A. D. Hesse, O. H. Ruiz, sales engineers.

Keystone Lubricating Company, Booth 3
21st Clearfield and Lippincott Sts.,
Philadelphia, Pa.

Keystone greases for all mechanical and temperature conditions, also safety lubricating systems of manual, spring, automatic and pneumatic types will be displayed, with Keystone force feed grease pumps. Of special interest will be two units of machinery in operation, both equipped with the Keystone system, and the force feed grease pump which is a new development and will be exhibited for the first time at the show. Another new device will be a trip valve for lubricating systems.

Representatives: H. A. Buzby, president; F. D. Street, sales engineering department, in charge of booth; A. T. Lowry, New York district manager; L. A. Webster, New England district manager; C. O. Norstrum, H. M. Ludwick, lubricating engineers.

Keystone Refractories Co., Booth 11
120 Liberty St., New York, N. Y.

This exhibit will consist of a display of the company's products, Dura-Stix high temperature cement, Steel-veneer and Crundumsand, granular refractories, Plastobrix, a plastic fire brick, also the Keystone refractory sprayer, designed to shoot these materials onto furnace walls.

Representatives: Frederick W. Reisman, president and general manager, in charge of the exhibit; L. E. Turk, secretary and treasurer; B. G. Pitcher, P. Murphy, F. M. Leach.

Walter Kidde & Company, Inc.,
140 Cedar St., New York. Booths 292, 293

Fire extinguishing apparatus, including the Lux system, and Lux portable extinguishers in standard and junior sizes, will make up the exhibit in this space. Automatic built-in Lux systems of the type used to protect generators, oil-switch rooms and transformer vaults on electrical properties will constitute a special feature and their use for special hazards in industrial plants will be demonstrated. The Lux portable extinguisher is a new product, having twice the capacity of previously used extinguishers of this type, with weight held down to less than 50 lb. so that it is readily portable.

Representatives: P. W. Eberhardt; L. B. Zuber.

Kieley & Mueller, Inc., Booths 281, 282
34 West 13th St., N. Y.

Products shown here will be pressure-reducing valves, temperature regulators, steam traps and pump governors of the company's well-known make. Sectional models will illustrate the construction and several of the specialties will be shown in action to demonstrate their smooth and effective working.

Representative: C. H. Dutcher, manager.

Kilsoot Chemical Co., Inc., Booth 259
1834 Broadway, New York.

Exhibit will be made of KilSoot, a chemical in powdered form for removing soot and carbon deposits from boilers and stacks and for preventing fires. It is intended to be thrown on the fire in the fire box and is claimed to turn soot wherever met into vapor form which passes out with the flue gases. It is also claimed that it will put out fires in chimneys, if thrown into the fire box in a considerable quantity after the fire in the chimney has started.

Representatives: E. L. Geldert, president; Wm. A. Illigen; M. H. Hogan; L. Valenti; Wm. Perreault; Wm. O'Connor.

Kissick-Fenno Company, Booth 19
15 Park Place, New York, N. Y.

Products to be shown here will be the American ring crusher, Whiton-Lee steam turbine and the Forney gas burner for which the company acts as New York representative.

Representatives: Joseph Kissick, Jr.; W. J. McDonough; G. F. Fenno; C. R. Fischer.

The LaBour Company, Booths 213, 214
Chicago Heights, Ill.

This company will have one of its self priming centrifugal pumps in actual operation, showing the ability of the pump to handle air and actually to prime itself with an empty suction line. In addition to the pumps, will be shown a new type of, acid valve and samples of acid-resisting alloy castings made from the company's alloy, Elcomet. This alloy is a distinctly new exhibit at the show and should prove interesting to any engineers concerned with corrosion-resisting problems, as tests in many chemical plants have proved its resisting characteristics.

Representatives: John H. Barker, New York representative, in charge of exhibit; C. S. Savage.

La Mont Corporation, Booth 619
200 Fifth Ave., New York, N. Y.

Products to be exhibited by this company will be the La Mont steam generators, La Montube water screens and water walls.

Representatives: Messrs. Stretch, Scheel, Anderson, Ernst, and Jacoby.

E. J. Lavino and Co., Booths 340, 341
Bullitt Bldg., Philadelphia, Pa.

This exhibit will display many varieties and grades of chrome ores from all parts of the world, in both crude and ground form, also Lavino chrome, magnesite and silica brick, Kromepatch, a multi-bond refractory cement, Neutragrog, a chemically neutral aggregate for monolithic construction and plastic K-N chrome, ready for molding in place. Features which will have the greatest interest for the largest number of power plant men will be the plastic K-N, chrome ore and the Kromepatch cement, in which the company engineers have considered the two major forces causing destruction of refractory linings, namely chemical reaction from scale ash and other fluxes, and physical destruction due to abrasion and internal strains. The company has specialized in the making of chrome refractories and uses tunnel kilns for burning chrome and magnesite brick.

Representatives: R. E. Griffith, manager refractories engineering and sales; H. A. Morlock, A. deMacedo, sales engineers; C. B. Reynolds, refractories engineer, chrome specialties.

Landis Machine Company,
Waynesboro, Pa. Booths 338, 339

A 6-inch Landis pipe threading and cutting off machine will be shown in actual operation threading and cutting off pipe. Other equipment shown will be various sizes of the Land-Matic head, the Landex head, Lanco head, Victor collapsible tap and style M Victor receding chaser collapsible tap. Details of the Landis pipe threading and cutting machine are its complete lever control, universal adjustment for front and rear chucks, self-aligning die head, and self-locking reamer. The Land-Matic, Landex and Lanco head are for application to turret lathes, automatic screw machines and hand operated threading machines respectively. The Victor tap is of collapsible type for use in stationary or rotary position and can be furnished for cutting any taper of thread desired.

Representative: E. I. Baker.

E. B. Latham & Co.,
Booths 314, 315, 321, 322
550 Pearl St., New York, N. Y.

Complete line of American blower equipment will be exhibited, including disc fans up to 42-in. and Sirocco type blowers up to 35,000 c. f. per min. capacity. These units are all of direct driven type and will be operated during the exhibit. New type heaters will be shown for from 100 to 250 sq. ft. radiation and other ventilating apparatus.

Representative: R. A. Hamilton, manager ventilation department, in charge.

Lead Lined Iron Pipe Co., Booth 10
Wakefield, Mass.

Wakefield Amalgamated Lead-Lined iron pipe, in both flanged and screwed types will be shown, also Lead-Lined gate, Y, globe and angle valves in the same types. Wakefield Pure Block-Tin-Lined iron and brass pipe and fittings in flanged and screwed form, and lead and tin covered pipe and fittings will also be displayed, and in addition a line of Lead-Lined Antimonial lead pipe, fittings and valves. Special features will be the lead-lined iron pipe, fittings and valves for boiler feed piping and for handling corrosive waters.

Representatives: J. D. Dwyer; T. E. Dwyer; D. F. Dwyer.

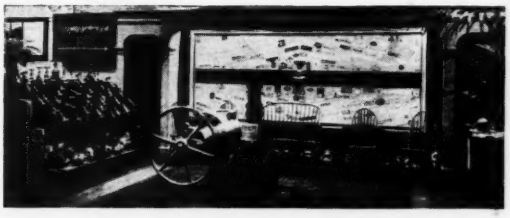
Leeds & Northrup Co., Booth 20
4901 Stenton Ave.. Phila., Pa.

Leeds & Northrup metered combustion control equipment will be fully displayed, and in addition there will be CO_2 recorders, indicators, resistance thermometer recorders of the automatic type, generator field temperature recorders, multiple point indicating and recording equipment including instruments and accessories. Specially featured will be a ground resistance test set equipped with sechommeter. Practically the entire exhibit will be in operation continuously during the show.

Representatives: L. O. Heath, in charge; I. M. Stein; B. F. Keene; D. E. Moat; J. H. Hayner; E. S. Bristol.

Leslie Co., Booth 499
Lyndhurst, N. J.

Pressure and pump pressure regulators, reducing valves and self-cleaning strainers will be the products displayed in this booth. The pump pressure regulator for centrifugal or turbine driven pumps will be the special feature and its method of operation will be fully demonstrated.



Representatives: S. I. Leslie, president; J. J. Cizek, vice president; J. M. Naab, secretary and treasurer; F. J. Thrush, J. A. DeLong, sales engineers; S. Soderberg, chief engineer; F. D. Riggio, sales department.

The Lincoln Electric Co.,
Cleveland, Ohio. Booths 558, 559

In this exhibit particular attention will be given to the Electronic Tornado process for making strong and ductile welds. In this process, superimposing a strong magnetic field on the arc flame focuses the arc and localizes the heating in a small area directly under the electrodes. Little heat is dissipated and this concentration permits faster traversing of the arc along the welds. Samples of work done and complete data will be available at the exhibit and the operation of the system will be explained, although it is impossible to demonstrate it at the show.

Representatives: J. F. Lincoln, president; A. F. Davis, vice president; G. N. Bull; S. G. Morris; Evan Lewis.

The Linde Air Products Co.,
Booths 334, 335
30 E. 42nd St., New York, N. Y.

Complete equipment and supplies for oxy-acetylene welding and cutting will be exhibited, showing the latest developments in the application of the oxy-acetylene process for the welding of pressure vessels and power plant piping and the making of repairs to power plant equipment.

Representative: R. W. Boggs.

Lockwood Trade Journal Co., Inc.,
10 E. 39th St., New York. Booth 522

This exhibit will be devoted exclusively to the company's publications, including Paper Trade Journal, Lockwood's Directory of the Paper and Allied Trades, and the American Stationer and Office Manager.

Representatives: A. A. Tanyane, general advertising manager; A. E. Gordon, G. W. Van Steenbergh, advertising representatives.

McGraw-Shaw Company, Booth 427
7 So. Dearborn St., Chicago.

In this booth, display will be made of Factory and Industrial Management and Industrial Engineering, also of books on allied subjects.

Representatives: O. S. Wernecke; F. Morse Smith; H. K. Dunn; E. A. Robison.

McQuay Radiator Corp., Booth 300
35 E. Wacker Drive, Chicago, Ill.

Special radiation in various forms will be shown here, including a complete set-up of the company's concealed radiation, cabinet and bathroom radiation, panel type underwindow radiation, and unit heaters. As a special feature of the exhibit will be shown the floor type of unit heater and new concealed forms of radiation.

Representatives: R. C. Malvin, general sales manager; M. F. May; James Humphreys; W. Taylor Roberts; W. J. Burke; H. B. Osmundsen.

Mall Tool Company, Booth 459
7740 So. Chicago Ave., Chicago, Ill.

Included here will be portable machines for grinding, equipped with the Mall flexible shaft as adapted for grinding and polishing in construction and machine shop work.

Representative: S. E. Kilbourn.

Manufacturers Record, Booth 40
Baltimore, Md.

Display signs showing a condensed summary in facts and figures of the South's progress and development will be shown here and the journal will be on display, also a Blue Book of Southern Progress.

Representative: N. W. Rynard.

Marburg Bros., Inc., Booth 617
90 West St., New York.

Precision die filing and sawing machines for use in making dies and jigs; also samples of work produced by these machines.

Representatives: Theodore H. Marburg, president; Louis C. Marburg, secretary and treasurer.

Mason Regulator Co., Booths 221, 222
Dorchester Center, Boston, Mass.

Mason bronze and iron body reducing valves, pump pressure regulators, hydraulic damper regulators, solenoid valves, liquid level controllers will be among the products of the company to be found in this display. Special features will be the cut away section of valves showing stainless steel working parts and the improved construction of iron body standard reducing valves.

Representatives: F. K. Morrison, in charge of booth; F. A. Morrison; H. L. Colby, mechanical engineer.

The Maxim Silencer Co., Booths 423, 424
410 Asylum St., Hartford, Conn.

Maxim silencers as applied to Diesel engines, air compressors, blowers, pumps and general power plant equipment will be displayed, covering the entire line of the company's products. A complete line of silencers for small air compressor service will make a special feature of the exhibit and, as new products, will be shown small, light weight silencers for large size gasoline motors.

Representative: W. D. Stone, sales manager.

The Mercoid Corporation, Booths 215, 216
25 Church St., New York, N. Y.

This company, which is a combination of the Federal Gauge Co. and the Arcless Contact Co., will show a standard line of automatic Mercoid electrical controls, as used in connection with oil burners, forced and draft coal burning equipment, unit heaters and refrigeration in industrial applications for control of temperature, pressure and vacuum. As a main feature will be shown a newly developed line of oil burner safety controls, Mercoid combination low water cutoff and pressure control and devices for close regulation of steam pressures up to 200 lb. and temperatures of 600 deg.

Representatives: N. J. Allaben, executive vice president; I. E. McCabe, chief engineer; A. N. Schultz, electrical engineer; W. K. Stauffer, sales engineer; A. W. Barr, special Canadian representative; C. A. Bier, sales department; H. A. Matthews, sales engineer; E. J. Holland, secretary.

Midwest Air Filters, Inc., Booth 342
Bradford, Pa.

Midwest automatic self-cleaning filters, manually cleaned unit filters, compressor and Diesel engine filters, the new Midwest humidifier and Midwest steel stringers, box rails and inserts will be found in this exhibit, making up the complete line of the company's products. Featured especially will be the new Midwest vertical sinuous automatic air filter, which is an entirely new development and worthy of careful investigation.

Representatives: E. S. Bishop; B. A. Benson; John Hellstrom; W. F. Kennedy.

The Alexander Milburn Co., Booth 732
1416 W. Baltimore St., Baltimore, Md.

Oxy-acetylene welding and cutting equipment, pressure regulators, welding generators, paint and lacquer spraying equipment, oil preheaters and carbide lights will be exhibited and demonstrated.

Representative: C. R. Pollard.

Mill & Factory Illustrated Booth 607
Graybar Bldg., New York, N. Y.

Copies of the Journal will be shown and the field which it covers explained.

Representatives: Harvey Conover, presi-

dent; M. G. Farrell, editor; E. M. Stanley, advertising manager.

Mine Safety Appliances Co., Booth 268
Pittsburgh, Pa.

Here will be found a complete line of safety equipment, particularly applicable to power and mechanical engineering plants, including the F-M continuous flammable vapor indicator, the Edison electric safety cap lamp, the McCaa two-hour oxygen breathing apparatus, first aid supplies, including a waterproof first aid kit with heavy duty case, danger signs, goggles, H-H inhalator for resuscitation, industrial gas masks, carbon monoxide recorder and detector, hose masks, safety clothing. The features to which special attention will be given will be the new F-M vapor indicator and the Type D waterproof first aid kits, the first a device to indicate the presence of vapors which might cause explosions in industrial plants and which gives a continuous record of conditions; the second, a kit especially designed for locations where rough usage is likely to be encountered and made up in four sizes for use on trucks, buses and in industrial plants.

Representatives: C. L. Turner, assistant sales manager; H. J. Segrave, district manager.

Mixing Equipment Co., Inc.,
Booths 279, 280
229 East 38th St., New York, N. Y.

Electric portable mixers for all fluids, propeller agitators, tanks and kettles will be found in this display. The portable mixer has a motor with clamp for attaching to the side of a vat or tank and driving a shaft on which are mounted one or more propellers for thoroughly mixing the fluids in the tank.

Representatives: F. L. Craddock, sales manager; C. H. King; J. J. O'Shea.

Modine Manufacturing Co.,
Racine, Wisconsin. Booths 219, 220

Complete line of Modine heating equipment for industrial, commercial and domestic heating will be shown, including unit heaters for industrial heating and drying, cabinet and concealed heaters for commercial and domestic heating and a working exhibit of unit heaters in operation.

Representative: C. J. Rice, sales manager, heating division.

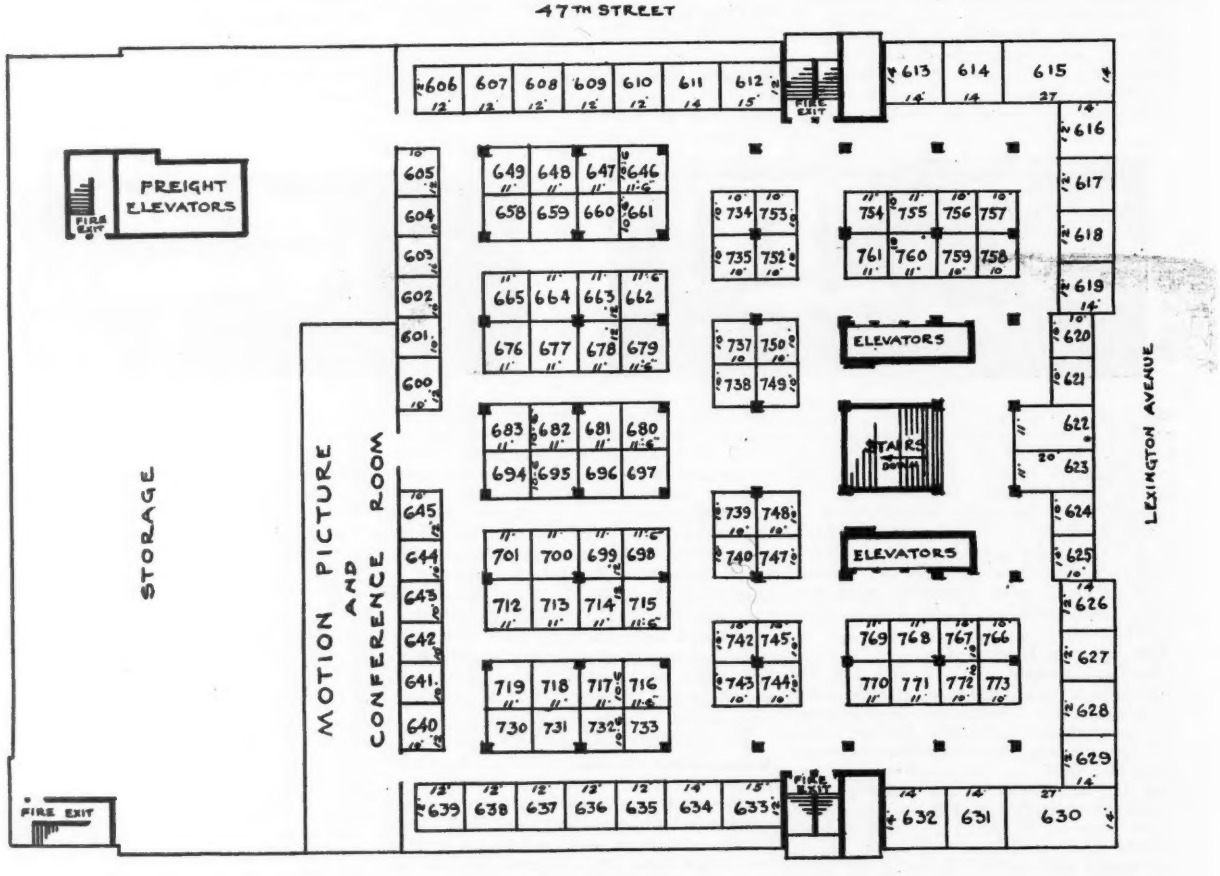
Morrison Machine Co., Booth 209A
204 Van Houten Street, Paterson, N. J.

Morrison patented speed reducing transmission will be exhibited and demonstrated in this booth. The special feature will be the running exhibit of this reducer with the highest standard ratio of reduction, namelv, 729:1 and especially showing the details of the interior construction. The latest improvement in this equipment is a change in construction, doing away with the use of a stuffing box to increase the efficiency and lessen the overall length. All operating parts are flooded with oil, but the apparatus is sealed to prevent any possible escape of oil and also to prevent the inlet of dirt or dust from the outside. Other features of the device are helically cut gears and a pump propeller for forcing lubricant to all parts of the equipment.

Representatives: C. H. Ramsey, president; B. R. Atkinson, chief engineer, in charge of booth; John C. Morrison, assistant manager; John Kreeft, designing engineer.

Morse Chain Company, Booths 263, 264
Ithaca, N. Y.

Included in the features of special interest in this space will be a motor drive enclosed in a case showing the Morse automatic oiler, also a small sample chain drive with gilt chain case and universal motor. Another exhibit will show clearly the method of lubrication for large drives. The new Morse flexible coupling will be shown for the first time, consisting of a chain wrapping two sprockets, one of these with a guide groove which holds the chain in place. The other sprocket has no guide groove and the chain is free to move back and forth on its surface, the display showing clearly how this simple coupling takes care of end play, general misalignment and angular variations. A feature which will interest visitors will be a nickel-plated chain running from two sprockets with the washers on one side removed and a handle provided so that the chain may be rotated,



ON THE FOURTH FLOOR WILL BE BOOTHS 600 TO 773;
ALSO THE MOVING PICTURE HALL

the exact action of the pins and links in going over the sprockets being clearly shown. A Morse spring sprocket will be exhibited in action to demonstrate its advantages.

Representatives: V. D. Morse; W. W. Bertram; A. B. Wray; C. L. Saunders.

Thomas E. Murray, Inc., Booth 64
55 Duane St., New York.

Pictures and models of power plants will be shown illustrating the work which the company does in the design and construction of plants.

Representatives: Walter M. Keenan, assistant engineering manager; F. B. Standiford.

Murray Iron Works Co., Booth 441
Burlington, Iowa.

Products to be shown in this exhibit will be two-stage steam turbine with upper half of the casing removed and a model boiler. As special features, improvements will be demonstrated in the design of Murray-Standard turbines and of the Murray Iron Works Co.'s boilers. The turbine is an axial-flow impulse type with one or more two-row velocity stages followed by a number of single row pressure stages. Demonstration will be made of the strength, compactness and the simplicity of the design and of the special nozzle arrangement which will change from one load to another by adjustment of four valves from the outside of the machine for wide range of pressure and operating speed.

Representatives: P. Schmertz, New York sales manager; J. Y. Dahlstrand, manager of turbine department; W. A. Gordon, Jr., Honolulu Iron Works Co., eastern representatives.

Mutton Hollow Fire Brick Co.,
Woodbridge, N. J. Booth 212

The company's Rineheit super-refractory clay products and Rineheit insulating clay products will make up the display in this booth. Different designs in both refractories will be shown as a special feature and their use in convenient and economical construction demonstrated.

Representatives: John F. Ryan, secretary; Charles Stegmayer, ceramic engineer.

Nathan Manufacturing Co.,
Booths 530, 531
250 Park Ave., New York, N. Y.

Mechanical lubricators adaptable for stationary plants and industrial uses will be shown in a full line with their operation demonstrated.

Representative: Mr. Haas, in charge.

National Co., Booth 76
61 Sherman St., Malden, Mass.

Illuminators for water columns and cell door hardware will constitute the exhibit in this space.

Representatives: C. E. Wilson, chief engineer; W. K. Sowdon, district representative.

National Lead Company. Booth 258
111 Broadway, New York, N. Y.

Cinch anchoring specialties will be shown, the main feature being a demonstration of the installation of these specialties, also transparencies showing typical installations.

Representatives: G. Kohler; Albert Eaton; L. H. Coates; C. S. Smith.

Neemes Foundry, Inc., Booth 56
206 First St., Troy, N. Y.

Automatic stokers, shaking and dumping grates will make up the exhibit in this booth, the automatic stoker being a new development, shown and demonstrated here for the first time.

Representative: R. R. Rees.

The New York & New Jersey Lubricant Co., Booth 770
292 Madison Ave., New York, N. Y.

This company will display a complete line of its non-fluid oils on which it has specialized for the past 30 years. They will exemplify the modern idea in lubrication, that is, adapting the lubricant to the exact lubricating need of machinery in the different industries.

Representatives: Joseph H. Bennis, vice-president; F. Helmich; T. W. Feeley; J. G. Robson.

W. H. Nicholson & Co., Booth 93
Wilkes-Barre, Pa.

An operating model of the Nicholson Super-Trap, piston operated, also the Nicholson Weight Operated trap will be shown in this exhibit. The piston operated trap wll be shown under a 10-lb. air pressure and the weight operated model at atmospheric pressure, both models having glass sides to make the internal construction and operation visible. Another interesting feature will be the motor-driven model of the Nicholson flexible coupling, showing its adaptability to misalinements of various kinds. Of the company's regular line, models will be shown of the Nicholson three and four-way valves, expansion steam traps and welded steel floats.

Representatives: H. S. Nicholson, manager; J. B. Armstrong; R. A. Comstock, New York representative; James T. Gordon.

Norton Company, Booth 318
Worcester, Mass.

The main part of this exhibit will be given up to a display of Crystolon (silicon carbide) bricks for boiler furnace walls. These are heavy duty refractories, non-clinkering and resistant to abrasion caused by the movement of the fuel bed in stoker-fired furnaces and to abrasion by the slice bar in hand-fired installations. As a special feature, a moving picture film entitled The Handling of Heat will be shown by means of a capital projector to illustrate the uses of a variety of Norton refractory products, the complete film being shown in the moving picture room with other industrial films. Alundum cement for setting bricks will also be displayed.

Representatives: Harry B. Lindsay, sales manager; F. E. Leiby, district representative; R. J. Gillander; Robert Kirkpatrick.

Wm. W. Nugent & Co., Inc., Booth 297
410 No. Hermitage Ave., Chicago.

In this space will be found an interesting exhibit and demonstration of oiling equipment and oil filters. The Nugent filter, utilizing filtering bags and heating by steam, hot water or electricity will be demonstrated, also the type with triple bag cabinet and that with automatic water separating and surface cleaning chamber for smaller plants. Use of these filters in an automatic continuous oiling and filtering system will be demonstrated. Systems of telescopic oiling for eccentrics, crosshead pins, crank pins and other moving bearings will be exhibited and the action shown. Another feature will be sight flows, flow alarms and non-flow alarms for single bearings and systems of multiple oilers. A new and unique feature will be the Nugent compression union pipe fittings and valves for pressures up to 1000 lb. with actual demonstration showing the use of these fittings and the method of testing them for tightness.

Representative: C. D. Nugent, in charge of booth.

Oakite Products, Inc., Booths 739, 740
22 Thames St., New York, N. Y.

This exhibit will be designed to illustrate graphically the many uses of Oakite in power plants, both large and small. Among these uses will be demonstrated the cleaning of oil coolers, surface condensers, turbo-generators, air compressors, station transformers, high-tension insulators, boiler fronts, electrical and mechanical equipment, windows, floors, ceilings and other parts of the establishment.

Representatives: J. F. Tonn; H. L. Gray; J. Carter; D. X. Clarin; V. D. Smith; A. W. Perry; J. Beckett; A. A. Kopp.

The Ocean Accident & Guarantee Corp., Ltd., Booths 442, 443
1 Park Ave., N. Y.

Here will be explained and demonstrated the insurance coverage available for boilers, engines, turbines and electrical machinery as placed by this corporation. A special feature will be a demonstration of the power plant and industrial accident prevention service to the company. A new feature will be power plant insurance in all its forms as modernized by the company, also perfected industrial and traffic accident prevention practice will be illustrated.

Representatives: Dan L. Royer, chief engineer, in charge of booth; J. G. Wheatley, traveling supervisor; E. L. Martin, Ralph Valentine, N. A. Pearson, supervising engineers.

The Okonite Company, Booth 493
501 Fifth Ave., New York, N. Y.

This company will show rubber, varnished cambric and paper insulated, super high tension power cables; also friction and rubber insulating tapes and portable reënforced cord.

Representatives: J. B. Underhill, sales manager; J. M. Bellavigna, sales department; R. M. Johnson.

Tinius Olsen Testing Machine Co.,
500 No. 12th St., Phila., Pa. Booth 92

The company's latest development, Herbert Cloudburst hardness tester, will be demonstrated in this exhibit, the tester enabling an operator to test finished parts all over for hardness and detect soft spots, also offering a means of superhardening steel and other metals. In addition will be shown the Herbert Pendulum hardness tester, Johnson hardness tester for the Brinell test, the latest direct motor driven production type Olsen Hydraulic Brinell testing machine. Other equipment shown will be the ductility testing machine, the latest extensometer and a new development in a strain gage, dynamic balancing machine, with centrifugal high-tension spark principle to balance rotating parts easily and quickly, automatic weighing static balancing machines for balancing clutches, clutch parts, flywheels and the like.

Representatives: T. Y. Olsen, vice-president and treasurer; R. B. Lewis; Jacob Lundgren; Bruce L. Lewis.

Paige & Jones Chemical Co., Booth 72
Hammond, Ind.

Visitors to this booth will find an exact model to scale of a 100,000-gal. double unit for zeolite water softening: also a

special wayside tank method of feeding the company's FFF boiler feedwater treatment. The exhibit will show the operation of the system and the construction of the various elements.

Representatives: C. L. Sidle, general sales manager; M. H. Cleaver, New York representative.

Palmer-Bee Company, Booth 528
Detroit, Mich.

Enclosed speed reduction units will make up the exhibit in this booth. Special features of the exhibit will include a display of four different styles of new herringbone speed reducers, at least two of which will be in operation. One of these units will have a portion of the covering removed and a pane of glass inserted to permit the observance of the gears in operation and the action of the lubricant. All units shown will make up an entirely new line of speed reducers, having herringbone gears and anti-friction bearings, which, in the single series are

Timken tapered roller bearings and, in the double and triple series, ball bearings on the high-speed shaft with Hyatt bearings on the intermediate and Timken bearings on the slow speed shaft.

Representatives: K. D. Kysor; L. E. Gannon, advertising manager.

The Peerless Electric Co., Booth 500
Warren, Ohio.

Electric motors, exhaust and industrial utility fans, flexible shaft, bench and portable grinders, desk and furnace fans, window ventilators will make up the display of this company. The Peerless window ventilators and the Utility ventilators are especially for household use, both being demountable and removable to any desired location. The Man Cooler is especially for industrial work, a fan of multi-blade type, mounted on a pedestal and with guards to prevent catching of any extraneous material in the blades. All products, except the motors and desk fans, are new products, shown for the first time this year.

Representatives: C. A. Sticht, in charge of the booth; J. M. Tuthill, sales manager.

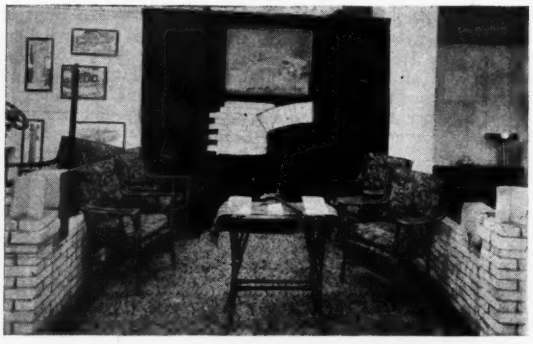
Peerless Machine Company, Booth 490
Racine, Wisc.

High-speed metal sawing equipment will be exhibited in various types, also power pipe threading machines of portable and stationary types. Special features shown will include high production on the sawing of metals and in particular on tool steels, in connection with the demonstration of equipment. In the pipe threading equipment the feature will be a small portable machine carrying practically all arrangements and features now included on large stationary machines.

Representatives: Chas. Rasmussen, president; I. M. Ward, vice president.

Henry Pels & Co., Inc., Booth 2
90 West St., New York, N. Y.

Shearing and punching machinery will be the features in this display, including a quadruple combination punch, plate shear, angle, bar and tee cutter and coper, in two sizes; an angle, bar and tee shear; a high throat punching machine. Of special interest will be the small size combination punch, shear, cutter and coper, for the small ornamental iron worker with capacities as follows: punching holes one inch in diameter through ⅜-in. plate; cutting angles 3 by 3 by ⅜-in.; shearing plates ⅜-in. thick; coping and notching angle bars. This is a new combination machine, of which the punch and shear ends can be used independently and simultaneously. The angle shear is arranged so that angles can be cut square or on the bevel in four ways, and can also cut round, squares and tees without changing knives, or can bevel the tees. The coper will make rectangular as well as triangular cuts and is always ready for use.



Representatives: E. E. Tailfer, in charge of booth; Thomas F. Kane, New York representative.

Pennsylvania Pump and Compressor Co., Booth 31
Easton, Pa.

One of the company's single-stage air compressors will be shown, equipped with Pennsylvania Air-Cushioned valves; also a full line of pumps which will include a heavy-duty, high-pressure, centrifugal boiler feed pump. Special exhibit will be made of an improved air-cushioned valve, which has four principal parts, seat, guard, discs and springs. Smooth, quick and quiet action is obtained by the use of an air cushion pocket in the guard, which prevents the valves from striking the metal on the guard as they open.

Representative: W. C. Peck, advertising manager.

Pepin's "Nojar" Clutch Co., Booth 569
67 Third Ave., Lowell, Mass.

Several of the company's clutches will be exhibited in this space and one of them will be demonstrated on a shaft operated by a motor showing the starting and stopping of machinery without jerk or slip due to the gradual engagement of the clutch after the motor has attained one-half to two-thirds speed.

Representatives: Nelson J. Pepin; E. G. Carroll; Robert C. Reed.

B. F. Perkins & Sons, Inc., Booth 743
Holyoke, Mass.

The Mullen tester in both hand and electrical driven types will be displayed, featuring especially the model B electric-driven machine and the core-testing equipment, including the transverse tester and a compression or green sand tester. All these are new features at this show, the Mullen tester being designed to test the strength of paper and fabric or of sheet celluloid. The motor-driven tester is especially for rapid and even work where a large number of pieces are to be tested, and the core tester is designed for use in foundries to determine the strength of the products of the core room.

Representatives: F. E. Tiffany, sales manager; Mr. Holmes.

Pipe Saver Corporation of America,
Carthage, N. Y. Booth 446

Pipe-savers as applied to joints in steam pipes for protection of the ends of the pipe will be displayed here and, as a special feature, sample installation will be shown of the pipe-savers in use. Easily inserted by means of a hammer and a block of wood, the pipe-savers protect the threaded end from corrosive action, thus prolonging the life of the pipe.

Representatives: Chas. Widemeyer, vice-president; J. L. Strickland, treasurer, in charge of booth.

Pitts and Kitts Mfg. & Supply Co.,
91 Seventh Ave., New York. Booth 278

Traps for high and low pressure, thermostats, both self-contained and auxiliary operated, water gages, gage cocks, water columns, damper regulators, reducing, back pressure, float, lever and blower valves, room thermostats and Birch pump valves will be included in this display. Special features of interest will be the Birch pump valve and the Swan thermostats for room temperature control which will be shown in operation. A new feature just introduced will be the pump valve with high and low arrangement, a patented feature, for increasing the output of the pump and prevention of slipping.

Representatives: James R. Hughes; Samuel Weinik; Joe V. Garneau; William Hayes.

The Portable Light Co., Inc., Booth 754
12 Warren St., New York, N. Y.

Portable emergency lights and searchlights will make up this exhibit, including the half-mile ray emergency searchlight for public utility companies. This is a portable device with a carrying handle having a storage battery contained in a steel box on which the light is mounted and will operate continuously for five hours.

Representative: W. V. Boom, in charge of booth.

The Porter-Cable Machine Co.,
Syracuse, N. Y. Booths 747, 748

Demonstration will be made of milling attachments, Syracuse sanders and grinders, Speedmatic floor surfacers, portable saw and Take-About sanders. A flexible belt sander and grinder will be shown for

the first time, designed for sanding irregular surfaces heretofore done by hand.

Representatives: A. B. Patterson; A. N. Frecker; G. Erickson.

The Power Plant Equipment Co., Booth 76W
1737 Walnut St., Kansas City, Mo.

The principal exhibit in this space will be the Marley line of spray cooling equipment, showing the details of the system and illustrating the installation of the system as a whole. This company will in the future be known as The Marley Company and will have its own New York office.

Representative: F. W. Greene, New York sales manager.

Prat-Daniel Corporation, Booths 241, 242
101 Park Ave., New York.

Thermix dust removing fans and stacks will be exhibited, also Thermix streamline stacks, air preheaters and adjustable soot blowers for air preheaters. As special features, there will be shown Thermix type 4 dust eliminating fan or stack, designed especially for pulverized fuel installations for collecting fly ash and extremely fine dust from the gases.

Representatives: Louis C. Whiton, Jr., general manager; Jeo C. Hardigg, chief engineer; John E. Watson, mechanical engineer; A. B. Carle, district sales manager.

Preferred Utilities Co., Booths 303 to 305
33 West 60th St., New York, N. Y.

In this space will be found exhibit of Ray commercial type fuel oil burners and turbine drive marine burners, also Ray direct-drive, direct-current marine burners and full automatic fuel oil burners. The Hart Model D automatic fuel oil burners will also be shown. The automatic burner will be equipped with simplified and improved controls and the domestic Hart burner with vacuum feed eliminates possibilities of leaks and of back-firing. This is a new exhibit at the exposition.

Representatives: R. S. Bohn; J. S. Kaplan; J. J. Spalding, Jr.; Arthur Roberts.

Production Machine Company,
Greenfield, Mass. Booth 734

To be found in this display will be automatic centerless feed, polishing and finishing machines and combination disc grinders and belt polishers. A large automatic centerless feed machine will be shown in operation with range of work from ⅛ to 6 in. in diameter of any length, used for polishing and finishing cylindrical work, either straight or tapered and feeding the piece automatically at rates of feed from 5 to 30 lineal feet per minute. A small machine will also be shown with the centerless feed for cylindrical work, combined with a flat machine for flat surfacing and polishing. Combined disc grinder and surfacer will be demonstrated, all these machines being direct connected to motors and in operation to show actual working conditions.

Representative: A. H. Behnke, vice president.

Pulmosan Safety Equipment Corp., Booth 758
176 Johnson St., Brooklyn, N. Y.

Safety equipment, including goggles, respirators, helmets, gas masks, dust respirators, paint spray respirators, safety ladder feet, first aid kits, and other safety devices will be shown. Devices to protect workmen in plants from dusty occupations will form a special feature of the exhibit and, for the first time, will be demonstrated certain improvements in the new goggle respirator combination, in paint spray respirator and paint spray masks.

Representatives: Frederick Wahlert, president; W. H. Harnden.

The Pyrometer Instrument Co., Booth 202
50 Howard St., New York, N. Y.

Pyro radiation pyrometers, optical pyrometers, insertion pyrometers and surface pyrometers will be displayed, illustrating the features of construction and the purposes to which each type of pyrometer is particularly adapted.

Representatives: F. Heidorn; E. R. Wilner; A. Bollerman.

Quaker City Rubber Co., Booth 645
Wissinoming, Philadelphia, Pa.

Belting, hose, packing, rubber goods and washers will be shown here for power plant use, heating and ventilating plants, refrigerating plants, power transmission, machine shop use and safety equipment. Special features will be the Daniel's Ebonite sheet packing, PPP rod packing, Ironsides belting and hose.

Representatives: E. P. Weber, sales manager; F. F. Wickes, district manager; P. H. Potts, branch manager; J. R. Menish, D. F. Manice, salesmen.

Quasi-Arc Incorporated, Booth 633
11 West 42nd St., New York, N. Y.

Here will be shown the Quasi-Arc, yarn-covered electrodes and welding equipment.

Representative: H. L. Ammann, technical director.

Quigley Furnace Specialties Co., Booth 89
26 Cortlandt St., New York, N. Y.

Hytempite, the Quigley refractory gun, triple-A protective coatings, acid-proof cement and Ganisand will be the special features in this exhibit. An electric furnace demonstration will be made, also moving pictures will be shown and a cascade of commercial acids over metals which have been protected with the triple-A coatings. As a special feature the Quigley emulsified asphalt gun for shooting asphalt regardless of whether or not it has a fibre content, will be demonstrated. This has a special trigger for handling the emulsified asphalt and is fitted with large wheels to facilitate transportation. It is a development from the principle of the Quigley refractory gun.

Representatives: W. H. Gaylord, Jr., vice president; C. C. Gantzman, D. F. McMahon, S. F. Murphy, Z. T. Rose, F. J. Spillane, service engineers.

Ramsey Chain Company, Inc., Booth 428
Albany, New York.

Ramsey silent chain drives in various forms will be demonstrated at this company's exhibit, an outstanding feature being the advantages of the roller bearing joint construction to give quietness, smoother flow of power and longer life to these chains.

Representative: Melville L. Merril, manager, New York office, in charge of booth; Neil E. Keeler, A. R. Derrick, New York office; Robert MacArthur, Albany district office; Ernest Ferris, manager Newark district office; E. J. Opie, superintendent of production and engineering; H. D. Parker, advertising manager.

Rathgeb Grate Co., Inc., Booths 749, 750
2365 Third Ave., New York, N. Y.

Fuel burning system water heaters will be shown and full demonstration of the action will be made during the show.

Representatives: Joseph J. Rathgeb, Jr.; L. Victor Harrison; Charles Osgood; A. E. Dobereiner.

The Rawlplug Company, Inc., Booth 539
66 West Broadway, New York.

This exhibit will contain Rawlplugs, Rawldrills and tool holders for holding screws fast in masonry construction. Two special features will be demonstration of the holding power of Rawlplugs against vibration and sudden shock.

Representative: H. G. Janton, exhibit manager.

F. I. Raymond Company, Booth 302
228 N. LaSalle St., Chicago, Ill.

Raymond Duo-Stats will be exhibited here, the main feature of the display being a high-voltage, low-voltage and gas actuated types.

Representative: F. I. Raymond.

Reading Iron Company, Booths 229, 230
Reading, Pa.

Wrought iron pipe, showing the development from the initial process to the finished product will be shown and the processes illustrated in this space.

Representatives: H. S. Carland; J. P. Feagley; H. S. Bard; S. H. Blackwood; J. L. Jacobson; A. N. Voripaieff.

Reeves Pulley Co. of N. Y., Inc., Booth 34
76 Dey St., New York, N. Y.

Various designs and models of the Reeves variable speed transmissions will be shown, particularly the new features of design and construction. In operation and on display will be the regular hand-controlled units, also units for remote electrical and mechanical control, automatic electrical and mechanical control, totally enclosed units, compact unit drives and the new Reeves double-block center-pull V-belt. A feature of special interest will be the compact design of variable speed transmission and the latest design of anti-friction thrust and radial bearings, mounting and lubrication.

Representatives: R. F. Reeves, secretary and treasurer; C. M. Reeves, vice president; P. B. Reeves, vice president; D. W. Clem, vice president; C. O. Irwin, H. B. Diehl, H. W. Randolph, E. R. Baum, sales engineers.

The Reliance Electric & Engineering Co., Booths 620, 621
1042 Ivanhoe Road, Cleveland, Ohio.

Alternating and direct current motors will make up the display in this booth, a feature to be emphasized being special motor protection as illustrated by fully-enclosed fan-cooled motor operating in a glass case with clouds of fine talc constantly stirred up. Another feature emphasized will be the importance and economy of using electric motors for reversing service.

Representatives: J. W. Corey, C. L. Peterson, Cleveland; R. H. Smith, Boston; C. D. Herbert, J. W. Picking, New York; E. E. Helm, E. A. Clark, Philadelphia.

Richardson Scale Company,
Clifton, N. J. Booths 14B, 15B

Richardson apron feed automatic crushed coal scale for weighing coal from overhead bunkers to hoppers above mechanical stokers or pulverizers which feed boilers will be exhibited in an actual size scale which will be in operation. A gravity-type elevator will be provided to deliver coal into a hopper with end gate located directly over the scale feed chute. The scale will make its weighings and discharge direct to the elevator, the installation being in effect as it would in an actual plant.

Representatives: Wm. F. Cohn, in charge of exhibit; C. R. Clark, New York office manager; E. A. Matthews, Philadelphia office manager.

The Ric-wiL Company, Booth 556
Union Trust Bldg., Cleveland, Ohio.

Ric-wiL underground conduit with Loc-Lip and external pipe supports will be shown in various types, also base drain, cast iron conduit, segment block conduit, manhole covers, conduit fittings and shutters and cradle base for sewers. One section will include the Dry-paC and No. 1 conduit filler insulation, filter cloth, Insulining and joint compound for sewers. The special features will be the Dry-paC exhibit and a model of a district heating system showing factory buildings receiving steam through Ric-wiL conduit from a central power station. A display will be made of conduit on base drain in various stages of construction. New products to be found in this display will be the filter cloth, designed to admit water but keep out sand, which is used to wrap joints in conduit; cast iron conduit with Loc-liP construction for heavy duty, the joint compound for calking sewer pipe joints, cradle base for sewers to improve the strength of the pipe and act as a drain and the Dry-paC, a waterproof asbestos conduit filler.

Representative: C. W. Lemmerman, New York office, in charge of booth.

Rivett Lathe and Grinder Corp.,
Brighton, Boston, Mass. Booth 454

This company will show the Blanchard Pulsating system of oil lubrication and a modern oiling system under the trade name of "Forkups." The Blanchard system will be in operation, demonstrating the results obtained by this method of lubrication which gives a pulsating circulation of oil through a complete, single circuit with individually adjusted feeder at each lubrication point. The Forkups device is a special system of oiling by means of cup and can which gives flushing of bearings when desired and continuous oiling at a slow rate at other times.

Representatives: Thorvald S. Ross, president; Frederick C. Blanchard, chief engineer; John N. Fauver, western distributor.

Roberts Steam Specialty Co.,
Booth 257
5325 Standard Ave., Cleveland, Ohio.

High-pressure floats, safety water columns, water gages, the Diamond weighted lever gage cock, the Gage-Lite for illuminating water gages and other steam specialties will be found here.

G. W. Osborn, president and treasurer; G. F. Sommer, secretary.

Robins Conveying Belt Co., Booth 298
15 Park Row, New York, N. Y.

Screen and conveyor idlers will be shown, also the company's equipment of belt conveyors, loaders and unloaders and equipment for conveyor installations.

Representatives: J. H. Robins, general sales manager; H. Von Thaden, assistant sales manager; H. Crissey, advertising manager; R. W. Eichenberger, Chicago office; Messrs. Keith, Fewsmith, Goedecke, New York office.

Rome Brass Radiator Corp.,
Booths 639, 640
1 East 42nd St., New York, N. Y.

Concealed radiators within the walls, light weight welded brass radiators for steam, hot water and vapor heating and portable electric steam radiators to give steam heat from electric wires, will make up the exhibit in this booth.

Representative: James D. Erskine, president.

Ross Safety Switch Corp., Booth 627
1 East 42nd St., New York.

Ross Safety remote control switches, type RVS automatic radiator control switches, Ross magnetic valves and Ross electric immersion heating elements will make up the display in this space.

Representatives: John D. Ross, vice president and general manager; James H. Van Alen, vice president; Alfred P. Walker, Jr., secretary-treasurer; H. H. Van Staagen; James J. Tyson.

The Roto Company, Booth 11
Newark, N. J.

Tube cleaners for boilers, condensers, evaporators, oil stills, locomotives and other tubular apparatus will here be shown and demonstrated, also boiler hand hole seat scrapers and cap cleaning machines. A special demonstration will be made of the cap cleaning machine, showing the effectiveness in securing tight joints after cleaning water-tube boilers.

Representatives: W. M. Kelley, J. V. Doherty, sales engineers.

Joseph T. Ryerson & Son, Inc.,
Jersey City, N. J. Booths 434 to 436

Tri-Lok gratings and Mason safety treads, for which this company is distributor, will be shown in booths 434 and 436 while in booth 435 will be found cross sections of the company's general warehouse line of structural shapes, plates and sheets, with specialties used in boiler construction. Glyco bearing metal, Firmtread steel floor plates, Allegheny metal and Ascoloy will also be shown with a display of small tools, including the new Millers Falls electric tool line. Of special interest will be found the Allegheny metal and Ascoloy and the Millers Falls tool line, which are comparatively new products. Representatives: J. D. Tryon, sales manager Jersey City plant, in charge of booth.

Rowland and Burns, Booth 48
39 Cortlandt St., New York, N. Y.

Single and multi-stage centrifugal pumps will be shown here in various sizes and with the details fully illustrated.

Representative: E. S. Quackenbush.

Sarco Company, Inc., Booth 33
183 Madison Ave., N. Y.

Various types of steam traps for the industrial field, also standard and special temperature regulators for hot water service tanks, industrial processing, dry kilns and the like, will be shown. The company will have a special line of regulators for refrigeration work suitable for temperatures from 0 deg. up and, as a special feature, the complete Sarco heating line, including inlet valves, thermostatic traps and other apparatus required for low-pressure vacuum and vapor heating systems.

Representatives: E. J. Ritchie; R. W. Cumming; E. E. Wells; R. C. Doerr; F. L. Sudhop.

Sauerman Bros., Booths 520, 521
438 S. Clinton St., Chicago, Ill.

Sauerman power drag scraper systems for storing and reclaiming coal and other bulk materials will make up the major part of this exhibit. As a central feature, will be a working model of such a system, representing a typical installation of this equipment in a coal storage yard at a power plant and showing just the method of use of the system for storing and reclaiming coal.

Representatives: G. R. Moore, in charge of exhibit; H. M. Cooper.

Scandinavian-Western Import'g Co., Ltd.,
107 Lafayette St., N. Y. Booth 447

Products to be shown will include circular saws for wood and metal cutting, lathe and machine knives of all kinds, files of all types and patterns, including a special circular-cut for filing soft metals and marble.

Representatives: J. K. Borch, president; H. A. Carmody, in charge of booth; Thomas Fox.

George Scherr Co., Booth 686
142 Liberty St., New York, N. Y.

Here will be shown in connection with the exhibit of the Atlantic Gear Works Co. of Brooklyn, a rotary cutting-off machine and a line of tachometers. Also gears and Duro noiseless pinions.

Representative: George Scherr, in charge.

Scovill Manufacturing Co., Booth 69
Waterbury, Conn.

Scovill cup-drawn Admiralty condenser tubing and condenser tubing ferrules, Scovill special muntz metal condenser tubing, sheet rod and bronze and nickel silver and Scovill new process cap screws will be included in the exhibit in this space. Special demonstration will be made of the ability of the Admiralty tubing and tubing ferrules and of the muntz metal tubing as to durability and resistance to corrosion.

Representatives: C. A. Gleason; A. G. Needham; A. H. Goepel; A. M. Rogers.

The Sharples Specialty Co., Booth 45
23rd and Westmoreland Sts., Phila., Pa.

The new Sharples high-capacity combination portable centrifugal device will be shown here for clarifying transformer and circuit-breaker oil. This device is equipped with centrifuge and twin blotter presses. Other features of the exhibit will be a Sharples Presurtite purifier and a cross section model of the larger size machine manufactured by the company.

Representative: W. L. Marston, assistant sales manager.

J. R. Shays, Jr., Inc., Booth 415
100 Greenwich St., New York, N. Y.

Products of the company's reproduction plant will be shown, including photographic samples, photostat and blue print samples, also map reproductions and reduced or enlarged Van Dycke prints. The special map reproductions by a new process will be featured and the process fully demonstrated.

Representatives: R. T. Shays, vice president, in charge of exhibit; W. Henderson, C. Owens, D. S. Spencer.

Shaw-Perkins Manufacturing Co.,
Booths 567, 568
Oliver Bldg., Pittsburgh, Pa.

Air preheaters and radiators will constitute the exhibit of this booth, the principal feature being the air preheater intended for heating combustion air for power plants, or other purposes such as heating buildings, drying chemical products, clearing mist from laundries, or textile plants. This air preheater is new and the first announcement of its showing will be at the Show.

Representative: Archibald H. Davis, Jr., vice president.

Shepard Electric Crane & Hoist Co.,
Montour Falls, N. Y. Booth 418

Two compact Liftabouts of new design will be shown in operation as a special feature. For the same capacity, these are smaller than the company's previous line. Display frames will picture the complete

line of hoisting equipment in capacities from ¼ t. to 30 t.

Representatives: R. T. Turner, sales manager; A. J. Barnes; R. W. Hurst; R. C. Vaughn.

Signal Engineering & Mfg. Co., Booths 404, 405
154 West 14th St., New York, N. Y.

Products to be exhibited will include magnet relays and switches of all types for contact capacities less than 20 amperes; audible signals of various types; complete fire alarm signal systems; code calling systems; tank alarm systems.

Representatives: J. H. Wheelock, treasurer; T. F. Herring, general sales manager; Norman McKinney, contract division manager; Fred L. Garrigues; V. P. Tassi.

Simonds Saw and Steel Co., Booth 468
Fitchburg, Mass.

Circular saws and planer knives for all types of electric, portable, hand-operated machines, also abrasive grinding wheels, files, hack saw blades and metal cutting saws will be shown in this display.

Representatives: R. A. Gilchrest; R. D. Baldwin, advertising manager.

Simplex Valve & Meter Co., Booth 76
68th & Upland Sts., Philadelphia, Pa.

Venturi type meters for boiler feed measurements will be shown here and their operation fully demonstrated to show the accuracy over a wide range of flow.

Representatives: H. C. Smith, advertising manager; M. M. Borden, general manager; W. K. Sowden, New York representative.

Skilsaw, Inc., Booth 465
3814 Ravenswood Ave., Chicago, Ill.

Four sizes of portable electric handsaws up to 4⅛ in. depth cutting capacity will be shown, operated from electric light sockets with universal motors. The smallest model cuts 2-inch dressed lumber and other sizes from that up.

Representatives: H. Gordon Hanley, New York manager; W. C. Farr, New Jersey representative.

F. L. Smidth & Co., Booth 210
50 Church St., N. Y.

Two products will be shown; one, the Lenix short-belt drive and the other the company's new Moler insulating brick. One of the standard Lenix drives will be shown in connection with a motor-driven pulley, the pulley having Prony brake by means of which can be demonstrated the automatic action of the drive in responding to variations in load. Advantages and method of using the Moler brick will also be demonstrated.

Representatives: V. Sahmel, T. Offral, electrical engineers; R. Salmonsen, J. Grant, mechanical engineers; O. Andreasen; B. F. Clark; A. B. Zahn, assistant treasurer.

Smith-Monroe Co., Booth 272
South Bend, Ind.

The Gast compressed air separator and compressed air aftercooler will be displayed here, the separator being shown in operation. Water will be admitted with the air to demonstrate that the separator will remove all moisture.

Representatives: R. O. Monroe, factory representative; Chas. W. Gill, New York representative.

Smith & Serrell, Booths 85, 86
Newark, N. J.

Francke flexible couplings for direct connected and geared motor, turbine and engine drives will be shown here in detail and as actually applied. The special feature will be couplings in operation showing the possibility of joining shafts which are out of line in all directions. Also several pieces of typical equipment using Francke couplings as standard will be displayed.

Other equipment shown will be a York Heating and Ventilating Co.'s unit heater, a motor-driven Quimby screw pump, D. O. James Co.'s motor-driven gear reducers and Foote Bros. Gear & Machine Co.'s reducers. Sectioned models of the couplings and reducers will show details of construction.

Representatives: John J. Serrell, in charge of booth; Messrs. Smith, Field, Gray, Christesen and Case.

Snap-On Wrench Co., Booth 445
14 E. Jackson Blvd., Chicago, Ill.

Snap-on socket and ratchet wrenches, Blue Point engineers' wrenches, Boxocket wrenches and other small hand tools will be displayed. Snap-on wrenches with special shanks for use on electric and pneumatic motors and an electrically operated demonstrating device to show the action of wrenches will be special features.

Representatives: N. E. Tarble, general sales manager; C. H. Tennyson, industrial engineer; F. C. Williams, New York branch manager.

Sowdon & Greene, Inc., Booth 76W
342 Madison Ave., New York.

Products will be shown as follows: For the National Company, Inc., illuminator for water columns and gages, also compartment door hardware and Philo draft gages. For Ernst & Co., forged steel water columns, adjustable-angle inclined and vertical gages, also try cocks. Especially featured will be complete trimming for high pressures, showing the new style of gages and leakless try cocks. For the Marley Co., formerly the Power Plant Equipment Co., will be shown Marley spray ponds and cooling towers, superheaters and steam purifiers. For the Schade Valve Manufacturing Co., will be shown steam and water valve specialties, special regulators and controls.

Representatives: W. K. Sowdon; F. W. Greene.

Spencer Turbine Co., Booths 516, 517
Hartford, Conn.

This company will exhibit its stationary vacuum cleaner, or pneumatic sweeping equipment, especially designed for application to power plants. It will also exhibit a slow speed multi-stage vacuum cleaner with separator and a complete line of hose and cleaning implements for various applications. Of particular interest to those who attend the Show will be the Spencer turbo compressor to supply air for moderate pressure and vacuum for oil and gas burning industrial furnaces, foundry cupolas, agitation of liquids and the like.

Representative: F. A. Wright, in charge of exhibit.

Sprucolite Corp., Booth 611
Bloomfield, N. J.

Sprucolite power transmission products will be shown here in a complete line consisting of pulleys for all applications for the use of flat, round and V belts, also non-metallic gears, rolls, wheels, and other transmission equipment. Groups of pulleys in motion and a complete short-center V belt drive will form the special features of the exhibit. All these products shown are made of highly compressed spruce.

Representatives: F. R. Andrews, in charge of exhibit; Messrs. Miller, Covell, Miles and Yeager.

Standard Oil Co. of New York,
370 Seventh Ave., N. Y. Booth 206

Products shown here will be the Socony industrial lubricants, including engine and machine oils, steam cylinder oils, turbine oils, cutting oils, core oils, greases, paraffine wax, and the like. As a special feature, a sample rack will be displayed of the modern illuminated type showing samples of the various products. New products will be exhibited, including a line of turbine and Diesel engine lubricants, also the Socony Turex brand.

Representatives: C. W. Kendall, New York City department industrial sales manager; T. G. Atlee, S. W. Mudge, N. C. Butler, Jr., special technical representatives.

Star Expansion Bolt Co., Booth 277
147 Cedar St., New York, N. Y.

Sebco products, including all varieties of expansion bolts, anchors and toggles for attaching fixtures, piping and transmission circuits to masonry walls, also tools for making installations will be found in this exhibit.

Representative: A. R. Van Tassell, field engineer in charge.

Staynew Filter Corp., Booths 419, 420
Rochester, N. Y.

Air filters, for use with air compressors, Diesel engines, building ventilation systems and on pipe lines for cleaning air or other gases, will be exhibited here. Apparatus for cleaning air and cleaning the filters will also be shown. These devices are built with a housing of heavy pressed steel, enclosing a filter unit of felt formed into pockets over radial wire screen fins and grouped around a central

outlet. This gives a large area of felt in a compact space supported so as to make the entire area available. For pipe line service, the housing is so arranged that air passes in at one end of the device and out at the other . For other purposes, the arrangement is such that the filter acts as a head through which the incoming air is drawn and, for ventilating systems, panel filters are provided.

Representative: L. L. Dollinger, president.

Sterling Engine Co., Booth 55
1252 Niagara St., Buffalo, N. Y.

The new Sterling Viking gasoline engine will be shown with cylinder 8 in. bore by 9 in. stroke and six and eight cylinder types for 565 hp. at 1200 r. p. m. The Sterling-Dolphin engine will be exhibited in four, six and eight cylinder types as used for driving pumps and standby generators, on railroad cars and for mine service. As a background modernistic display will depict the uses of Sterling engines and furniture of the booth will be in futuristic design giving a unique setting for the exhibit.

Representative: M. E. Mutchler, manager of sales.

Stimmel Winch & Mach. Wks., Booths 452, 453
542 W. 22nd St., New York.

Electric and hand winches will be shown with elevating hoists especially featured.

Representative: Leonard Stimmel, in charge.

Stockham Pipe & Fittings Co.,
Birmingham, Ala. Booth 557

Cast steel flanged fittings and cast steel screwed fittings will be shown here in both light and heavy types, made in accordance with the tentative American standard. Special fittings of malleable iron, for oil up to 175 lb. working pressure and for hydraulic pressures will also be shown and the features of these fittings demonstrated.

Representatives: C. L. Wilkins, New York branch manager; Douglass Stockham; Roy L. Stewart; Messrs. Dodson and Winkopp.

Louis E. Strong Pkg. Co. Booth 430
19 Hudson St., New York.

Specialties such as discs, hose and packing will be exhibited. Featured will be Lespaco style 300, Supertite sheet packing and style 100 shredded metallic packing. Flax. hydraulic and other types of packing will also be shown.

Representatives: Louis E. Strong, president; Frederick C. Meffle, manager.

B. F. Sturtevant Co., Inc., Booths 78, 79
Hyde Park, Boston, Mass.

Vacuum cleaners and multistage compressors will make up this exhibit. The stationary cleaner will be equipped with primary and secondary collectors, and heavy duty portable cleaners will also be shown. Multistage compressors for handling air or gas at higher pressures than can be obtained with single stage blowers or exhausters will be exhibited to cover a considerable range in volumes and pressures.

Representatives: G. W. Allen; W. R. Yundt.

Sturtevant Mill Company, Booth 44A
Harrison Square, Boston, Mass.

The Sturtevant automatic coal crusher and sampler for mechanically sampling coal will be placed before power plant engineers in this exhibit. This permits, in conjunction with the unloading and storing to the bunker, withdrawal of a representative sample of coal as it is passed to the bunker, the machine reducing this in size to about ¼-in. and finer and extracting a certain percentage as desired, 5, 10 or 15 per cent. The sample removed can be put through a riffle and halved as many times as may be desired to reduce to the laboratory sample needed. A second feature will be the company's complete line of crushing, grinding, screening, conveying and elevating equipment, especially the Whirlwind centrifugal selector, which separates various products by air with but small use of power. It is for operation on dry separation for materials finer than 50 mesh. The automatic coal crusher and sampler is of special interest to power plant men and the other apparatus will be of interest to executives who have any material handling problems to solve.

Representatives: W. T. Doyle, manager of the engineering department; J. S. Vrabek, eastern sales manager; H. A. Wilkins, sales engineer, New York.

Sumet Corporation, Booth 513
1543 Fillmore Ave., Buffalo, N. Y.

This company will show a complete line of rough and finished bars and castings, also bronze drawn rods in various diameters and lengths. The Sumet process is a special method of distributing lead evenly through the matrix of copper which supports it, thus giving a bearing with the strength of bronze and the antifriction qualities of lead. A special feature of the exhibit will be a motor running at 1800 r. p. m. with a Sumet bearing on the shaft and sufficient friction applied without oil to bring the bearing to a heat of 800 deg. F., to demonstrate the conditions which this bearing metal will endure.

Representatives: H. O. Warner, sales manager; H. D. Mitchell, chief engineer.

Sundh Electric Company, Inc., Booths 524, 525
5 Avenue C, Newark, N. J.

Electrical control devices will be shown here for all classes of electrical apparatus, including as a special feature of the exhibit automatic control for accurate speed and temperature.

Representative: Henry J. Kaufman, general sales manager.

The Swartwout Company, Booth 75
Cleveland, Ohio.

Products to be shown here will include feedwater regulators, differential pressure valves, pump governors, reducing valves, master controls, desuperheater governors, steam separators, oil separators, exhaust heads, high-pressure bucket traps, low-pressure float traps, drainage controls, feedwater heaters, boiler return traps, lifting traps and rotary ball-bearing roof ventilators. A new product, the desuperheater governor, enables the user to control the water admitted to a desuperheater so that any desired degree of superheat can be maintained in the steam, even though the steam pressure may fluctuate. The device employs the powerful force of evaporated water to operate the governing valve.

Representatives: D. K. Swartwout, president; D. K. Swartwout, Jr., vice president and general manager; L. P. Russon, sales manager of ventilator division; H. S. Fraser, New York office manager; P. R. Jones, New York representative on ventilators; J. W. Johnson, New Jersey representative.

Sweet & Doyle F'd'y & Machine Co.,
Troy, New York. Booth 477

The new S & D system for converting solid fuel heaters to gas fired will be shown and demonstrated.

Representative: Harry H. Dodge.

C. J. Tagliabue Mfg. Co. Booth 59
18 Thirty-third St., Brooklyn, N. Y.

New instruments to be exhibited here will include round case, flush type, panel board, recording instruments, automatic steam operated controller, TAG automatic recorder-controller, which has a special adjustment for the method of control, whether on-and-off or throttling. Other features in the exhibit will be industrial thermometers in various forms with easy reading red column, recording thermometers and pressure gages, barometers, absolute pressure gages, U gages, the TAG Mono automatic CO and CO_2 indicator-recorder and testing instruments for lubricants and fuel oils.

Representatives: Victor Wichum, chief engineer of the research and engineering departments, in charge; E. E. Corbett, head of the recorder and controller division; R. H. Wilhelm, head of the oil testing and mercurial thermometer division; W. C. Begeebing, assistant chief engineer; A. Traudt, Jr., engineering department; M. F. Behar, advertising manager; A. C. Homeyer, L. M. Hachenberg, O. C. Etterwendt, sales engineers; M. Malone, service department.

Taylor Instrument Co., Booth 507
Rochester, New York.

Industrial thermometers, recording thermometers and pressure gages, Dial-type index thermometers, mercury column vacuum gauges, indicating and recording pyrometers and engraved stem thermometers for testing, will be shown by this company. Special features will be a new flush type, mounted, mercury column vacuum gage which is designed for panel board mounting, in line with modern practice in power plants.

Representatives: J. W. Schwarz; J. P. Gilmore; W. N. Maurer; H. W. Kugler; W. J. Marlborough

The Texas Company, Booths 227, 228
17 Battery Place, New York.

Petroleum products will be shown here, including lubricating oils, greases and a demonstration of the different grades of oil and the purposes for which they are suited.

Representative: I. M. Williamson, assistant district manager.

Thermal Unit Co., Booths 203, 204
Union Stock Yards, Chicago, Ill.

Two Model 20 thermal units will be shown in operation, one with steam passing through the unit, raising the temperature, the other with refrigerant passing through the unit, lowering the temperature. In both cases, streamers will be attached to the deflectors and an electric motor driving the fan will produce approximately 3000 cu. ft. of air at 1000 ft. per minute. An ice machine will also be installed in the booth to produce refrigeration for one of the thermal units. By means of section parts and catalog features the mechanical strength of the integral castings will be shown, also the low resistance to air flow. The unit consists of radiating surfaces mounted in a casing on which is also mounted a motor-driven fan for producing the air circulation.

Representatives: T. W. Carraway; J. R. Cooper; F. Ruoff; R. O. Zobel.

Thermo Service, Inc., Booth 679
101 Park Ave., New York, N. Y.

A triple service boiler showing how this can supply the three services of efficient heat, automatic domestic hot water heating and incineration will be displayed. It

will be of welded steel, water-tube construction.

Representative: R. Kuhlmann, manager.

Tidewater Oil Sales Corp., Booth 15A
11 Broadway, New York, N. Y.

A full line of industrial oils and greases will be exhibited together with a form of motion picture illustrating certain well-known industrial plants, lubrication problems and the performance of lubricants.

Representative: W. B. Joachim, in charge.

Timken Roller Bearing Co.,
Canton, Ohio. Booths 232, 233

One feature of this exhibit will be a mechanical display portraying the wide use of Timken bearings in industrial and automotive equipment. Also will be shown a bearing of the type used on steel mill roll necks and a complete railway bearing and mounting, the latter cut away to show details of construction. Included in the exhibit will be various bearings of types suitable for different applications.

Representative: S. C. Merrill, New York, in charge.

Topping Brothers, Booths 288 to 291
159 Varick St., New York, N. Y.

Here will be shown products of various firms for which this organization acts as New York agent. Included will be acetylene welding equipment of the Torchweld Equipment Co.; Bearium cored and solid bars and castings of the Bearium Bearings, Inc.; electric tools, drills, screwdrivers, grinders and the like of Black & Decker Mfg. Co.; simplex jacks of the Templeton-Kenly Co.; hydraulic jacks of the Blackhawk Mfg. Co.

Representative: George Schumacher, in charge of exhibit.

Torchweld Equipment Co., Booth 290
224 North Carpenter St., Chicago, Ill.

Gas welding and cutting equipment, acetylene generators, decarbonizing and brazing equipment, gas welding and cutting accessories and supplies will be included in this exhibit. As main features, visitors will be interested in the non-flash gas welding and cutting equipment and improved safety gas pressure regulators, whose operation will be clearly demonstrated.

Representatives: W. A. Slack, president; Allen Topping, J. Murphy, New York representatives.

The Trane Company, Booths 252, 253
LaCrosse, Wis.

Trane heating specialties will be displayed in this space including the unit heater, standard concealed and under-window concealed heaters, condensation pump, visible heat cabinet, bellows packless valves, bellows radiator traps, high-pressure and thermostatic traps, vents and strainers. As special features, the Trane unit heater, a new model, with increased capacity, will be exhibited in actual operation, operated by means of a gas boiler. Also, the new under-window concealed heater, designed to allow easy installation, will be shown for the first time, this as well as the standard concealed heater being shown installed in complete wall sections operated by means of a gas boiler. The new model Trane condensation pump, a new line of centrifugals, will be displayed and operated in connection with the concealed heater and unit heater. New design of bellows packless valve and of the float trap will also be displayed.

Representatives: Reuben N. Trane; W. F. Bilyeu, in charge of the booth; Wm. Ehrlich, manager New York office; W. F. O'Brien; Messrs. Jennings, Siedler, Packman, Anderegg.

H. O. Trerice Company, Booth 267
Detroit, Mich.

This company's products will include the Trerice steam trap and the Trerice air gun. The steam trap has a propeller on the bottom of the bucket which serves to rotate the valve and makes it seat at a different point each time the trap discharges, thus keeping the valve steam tight and reducing wire drawing.

Representatives: H. O. Trerice; R. W. Scott, in charge of booth.

The Tri-Lok Company, Booth 436
Pittsburgh, Pa.

This company will show Tri-Lok gratings, safety steps, concrete armoring, T-bar armoring for bridge floors and industrial buildings, cellar doors and ventilating grills. As a special feature a walkway with installation of Tri-Lok grating of various types, with stairs having the various types of grating will be displayed. Steps attached to the stringer will be exhibited and the methods of construction and finish demonstrated. T-bar armoring is a new feature recently introduced, produced by locking the stem of standard rolled T sections with the peculiar Tri-Lok joint. The design is intended to reduce dead load considerably, also the thickness of the floor and to give an armored surface to concrete flooring, which will prevent chipping from heavy wheel loads.

Representatives: Thomas M. Gregory in charge of booth: T. J. Joyce; Harry Nagin; M. O. Lange, B. C. Fair, Fred Mallinson, of Joseph T. Ryerson & Son, Inc., New York representatives.

Troy Engine & Machine Co., Booth 554
Troy, Pa.

Here will be found a display of the Troy enclosed self-oiling steam engine so arranged as to show the lubricating system which is built into the engine and is, therefore, an integral part of the equipment. Details of construction and separate parts of the engines will be shown so as to illustrate fully the design and the action.

Representatives: A. R. McMahan, Troy, Pa.; S. Rosenzweig, New York.

Union Manufacturing Co., Booth 610
New Britain, Conn.

Union spur gears, Acme and differential chain blocks and trolleys, also Union chucks for lathes, drill presses and drilling machines will be demonstrated.

Representatives: H. H. Wheeler, treasurer; George V. Murphy, New York office manager; E. I. Stevens, representative.

The Unishear Company, Inc.,
Booths 474, 475
270 Lafayette St., New York, N. Y.

A complete line of Unishears for cutting flat stock will be shown and demonstrated in both portable and stationary types. These are in capacities for cutting from No. 18 U. S. gage cold rolled steel up to metal ¼-inch thick.

Representatives: Ulrich Steindorff, president; Herbert J. Heller, vice president; George B. Shiras, sales manager.

The United States Electrical Tool Co.,
Booths 487 to 489
Cincinnati, Ohio.

Electric drills, grinders, buffers and other similar equipment will be shown and demonstrated in this space.

Representatives: George M. Lawrence, sales manager; W. B. DaSilva, New York, in charge of exhibit.

Veeder-Root, Inc. Booth 234
1775 Broadway, New York.

Counters for industrial purposes, tachometers for determining the speed of motors and the like and the company's system of production control by the use of remote control counters where the contact is on the machine and the counter is in a distant office will be shown. Remote control counters will demonstrate the method of recording production by measuring the speed of the operating machinery.

Representatives: J. T. Chidsey, president; G. H. Anthony, vice president; Ralph C. Coxhead, vice president; J. H. Chaplin, secretary and sales manager; H. H. Spaunburg, factory manager and Mr. Graham, superintendent, Bristol division; E. H. Crosby, factory and L. W. Stevens, superintendent, Hartford division; W. R. Merz, A. E. Kallinish, J. K. Light, W. C. Waldo, E. B. Smith, district representatives; R. H. James, field engineer; E. A. Slye, chief engineer: F. A. Bringolf, Chicago; C. P. Hessmer, Cleveland; W. A. Kennedy, Charlotte, N. C.; F. Somers Pekison, San Francisco; H. T. Sell, St. Louis.

Wailes Dove-Hermiston Corp.,
Booth 2N
17 Battery Place, New York, N. Y.

Bitumastic coatings for pipe lines and Bitumastic solution for general power house painting will be displayed and the advantages of the use of these products demonstrated in this booth.

Representative: George E. Boyd, in charge.

J. D. Wallace & Co., Booth 470
134 So. California Ave., Chicago.

Wallace portable machines will be featured here including the company's new

radial saw, the Solem thickness planer and a new line of small and inexpensive wood working machines adapted to home use and marketed under the name Workace.

Representatives: J. B. Murphy, New York sales manager; P. S. Hardman, F. L. Fox. E. P. Herrick, M. E. Evans, G. L. Seitz, sales engineers, New York office

Wappat Gear Works, Inc., Booth 471
7522 Meade St., Pittsburgh, Pa.

Labor saving tools will be shown here including the Alta electric planes, lock mortisers and hand mortisers. Demonstrations of the operation of the tools will be given during the Exposition.

Representatives: F. W. Wappat, president; J. P. Weidener, district manager.

Watts Regulator Company, Booth 39
250 Lowell St., Lawrence, Mass.

Products to be shown here will be valves and regulators, also the Watts unit for hot water house heating, consisting of a pressure relief valve, a pressure reducing valve and a strainer.

Representative: B. E. Horne, proprietor.

The F. M. Webber Co., Booth 301
2148 Graybar Bldg., New York.

Exhaust fans, Kool blast fans, blowers and airplane propellers will be found here with full description of new products and improvements. All these fan designs are new in the last two years and have a tip extending beyond the ring a patented feature, to give higher efficiency and prevent negative flow of air over the tip of the fan ring.

Representatives: F. M. Webber, manager; Fred Charavay; C. V. Vibber.

Warren Webster & Co., Booths 225, 226
Camden, N. J.

Webster system of steam heating and equipment for steam heating system will be displayed with the latest developments which have been applied in the company's various systems.

Representative: H. F. Marshall, advertising manager.

W. C. West Company, Booth 773
435 N. Michigan Ave., Chicago.

Products of the Central Valve Manufacturing Co. will be shown, including Replate, Multiplate and Perfection valves, the Replate valve being the newest product and fully described and illustrated in circulars to be had at the booth. As a special feature of the exhibit, pressure tests of various valves will be made during the show. The replate valve has the head of the stem capped with a removable cold-rolled, nickel plate which seats against genuine Monel metal; the headplate takes the greater part of the wear and can be replaced without removing the valve from the line. The valve is for service up to 300 lb. working pressure, with 550 deg. temperature.

Representatives: W. C. West, director of sales; C. S. Pope, vice president of the Central Valve Mfg. Co.; Chas. N. Shaffner, New York representative; Thomas F. Murray, Robert H. Nesbitt, Raymond H. Baker, salesmen; Craun-Liebing Co., Cleveland representative.

Weston Electrical Instrument Corp.,
Newark, N. J. Booth 505

A representative line of alternating current and direct current switchboard and portable instruments will be shown here and, in operation, a Weston Electric tachometer. The display will embody historical features, as this year marks the fortieth anniversary of the founding of the organization. Construction and principles of operation of the various instruments will be fully demonstrated.

Representatives: L. C. Nichols; E. R. Manning; H. M. Ricks; G. Williamson; H. L. Gerstenberger; W. G. Long; W. N. Goodwin, Jr.; C. B. Denton.

Whitney Metal Tool Company, Booth 455
Rockford, Ill.

Hand metal lever and ball bearing type punches, slitting shears, angle iron shears, angle iron notchers, angle iron benders, scratch awls, hollow punches, solid punches and deep throat punches will be among the products exhibited in this space. Special features will be the display of tools so that visitors at the booth can operate the tools themselves to discover their merits. New products to be shown will be the deep throat punches to punch a 2-in. hole in 3/32-inch iron. One punch will have an 18-in. throat depth and another 24-inch. throat depth.

Representatives: John Jensen, secretary; Gus. Jensen, sales representative.

D. E. Whiton Machine Co., Booth 19
New London, Conn.

Whiton-Lee auxiliary drive steam turbine will be exhibited for the first time with the casing open to show interior construction. Details of labyrinth shaft packing, excess pressure governor and No-water stops will also be displayed.

Representative: J. H. Leatherbee.

Williams Tool Corporation, Booth 631
Erie, Pa.

Three machines will be shown, including the company's portable 2-in. pipe threading machine, its 6-in. Rapiduction pipe threading machine with wrenchless chuck and its 104 pipe threading machine. No. 104 is a new product with a capacity of ½ to 4-in. pipe and constructed so that it can be arranged for either stationary or revolving type die head. This is a new product not yet announced to the trade and has as outstanding features, four changes of spindle speeds, geared headstock having steel gears and friction clutch running in oil, direct lubrication to dies, rapid adjustment from one size pipe to another, quick adjusting and rapid cut-off attachments, rapid reaming device, direct motor drive through silent chain and friction clutch and centralized controls within easy reach of the operator.

Representatives: E. P. Poole, vice president, in charge of booth; D. Moreinis, New York district sales manager; Victor Adler, New York representative.

T. B. Wood's Sons Co.,
Chambersburg, Pa. Booths 483, 484

This company will exhibit a complete line of power transmission machinery, Peerless tapered slip flasks and automatic adjustable pouring jackets. Special features shown will include flexible couplings, the U. G. Automatic belt contactor for short center belt drives, and a new friction clutch, known as the Peerless Unit-Adjusting clutch. This is of multiple free-floating disc type, in which all adjustment for load or wear is made at one point. Many other pieces of apparatus will be shown in operation to show the special features.

Representatives: W. H. Fisher; Albert H. Robbins; C. O. Wood; John J. High; G. H. Wood; A. Shaw; T. B. Wood; C. E. Bailey; E. H. Cargen; H. Stickel; F. M. Schiffmacher; G. R. Washinger.

Wright Manufacturing Co.,
Bridgeport, Conn. Booths 346, 347

Products to be shown include Wright high-speed screw and differential hoists, army type trolley hoists, hand and jub cranes.

Representatives: Richard F. Straw; George N. Walton; George A. Nichols.

Wright-Austin Company, Booth 28
315 W. Woodbridge St., Detroit, Mich.

All the standard steam specialties manufactured by this company will be exhibited, including its steam and oil separators, three types of steam traps, water columns and trimmings, exhaust heads, pump governors and feedwater regulators. As a special feature in the exhibit will be shown a Kleervu gage glass protector, the Crescent trycock with Monel metal valve and seat and the Airxpel bucket trap. Features of the Crescent trycock are the valve and seat, both renewable, and a friction washer between the weight arm and the stem, which permits the flexible adjustment of the position of the weight on the stem. The Kleervu protector is U shaped, of wire-mesh glass and eliminates the supporting rods so that the gage glass can be seen from every direction. It protects the glass, not only from mechanical injury, but from draft and protects operators from flying glass and hot water in case the gage glass breaks. In the Airxpel trap, operation is such that any air entrained into the trap is drawn up into the discharge tube and is expelled ahead of the condensate on the next discharge from the trap.

Visitors to the booth will be interested in getting a copy of the Alibi Shooter.

Representatives: C. B. Walter, president; H. Dusenbery.

The Yale & Towne Manufacturing Co.,
Stamford, Conn. Booths 425, 426

This exhibit will include a complete line of material handling equipment, including electric industrial trucks, tractors, trailers, Yale chain blocks, electric hoists, overhead traveling cranes and motor driven trolleys. New additions to the company's truck line are the model K24C 4-wheel steer, 4-wheel drive, heavy duty tractor, and the Model K26 6-wheel steer, 5-ton capacity, low lift elevating platform truck. Another new addition to the company's line is the Yale motor-driven trolley with a 2-ton Yale electric hoist attached. To assist exhibitors, this company will have a line of its industrial trucks at the Grand Central Palace prior to the opening and will also remain to render that service to exhibitors after the close, so as to illustrate the application of the truck equipment to exhibitors.

Representatives: R. E. Wilson, New York City truck representative; C. B. Veit, New York City hoisting equipment representative.

Zobell Electric Motor Corp., Booth 769
Garwood, N. J.

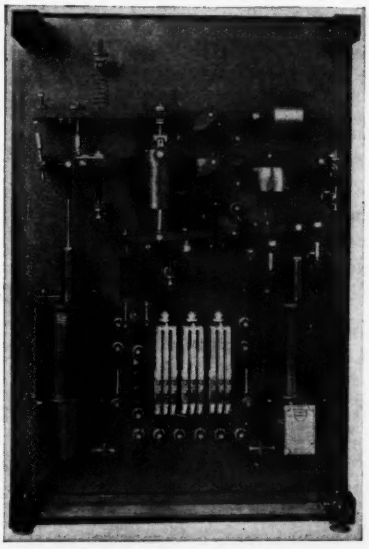
Electric motors and door operators will be displayed in this space, special emphasis being placed on the door operators which will be shown in action. These are propelled by a new type of direct current motor which makes it possible to reverse the motion of the door instantaneously, through push button control or other medium, causing the door to move at practically uniform speed. No springs or clutches are used and there is no dead center in the cycle of operation.

Representative: A. T. Zoebisch, general manager.

POWER PLANT ENGINEERING DEVELOPMENTS AND NEWS

Automatic Synchronizer Is Rapid in Operation

WORKING ON an entirely new principle, an automatic synchronizer has been developed recently by the Westinghouse Electric & Manufacturing Co. It provides an accurate and positive method of paralleling



NEW WESTINGHOUSE AUTOMATIC SYNCHRONIZER

two alternating current sources in a minimum amount of time with less possibility of damage to station equipment, and with lessened disturbances and lower surges on the transmission line to which the generators are connected.

This automatic synchronizer is designed to parallel two alternating current sources when the phase angle displacement between the alternating voltage waves is zero and the frequency difference is below a certain value, depending on the particular application. It can be adjusted to operate only between definite frequency difference limits and to close its contacts at a certain phase advance which will be proportional to the momentary frequency difference. The amount of advance, or the time elapsing between the energizing of the breaker closing relay and the closing of the breakers, can be varied by a single adjustment to suit varying conditions encountered in different circuit breaker applications. Tests run on this equipment prove that it will synchronize two alternating current sources more quickly and with greater accuracy than can be done manually. Additional tests showed that with automatic synchronizing, the circuit breaker closed 2 deg. or less off synchronism for 56 per cent of the total number of operations; while with hand operation, equally good results were obtained in only 19 per cent of the total number of operations.

Link-Belt Introduces Portable Flight Conveyor

NEWEST MEMBER of the Link-Belt loader family to enter the coal trade is a portable flight conveyor, furnished in 21, 26 and 31-ft. lengths. The new machine has been specially designed for the handling of all sizes and grades of coal and coke.

Framework is well braced and rigid, made of angles and plates; all frame and trough members are bolted and designed to be easily renewed when necessary.

PORTABLE FLIGHT CONVEYOR DESIGNED TO HANDLE 60 CU. FT. PER MIN.

Axles are of the swivel type, adjustable for different positions. A double strand of chain with special attachments constitutes the conveying medium, which moves at a speed of 124 ft. per min. through a 24-in. wide trough, designed to convey, materials at the rate of 60 cu. ft. per min., a ton and a half every minute when handling coal.

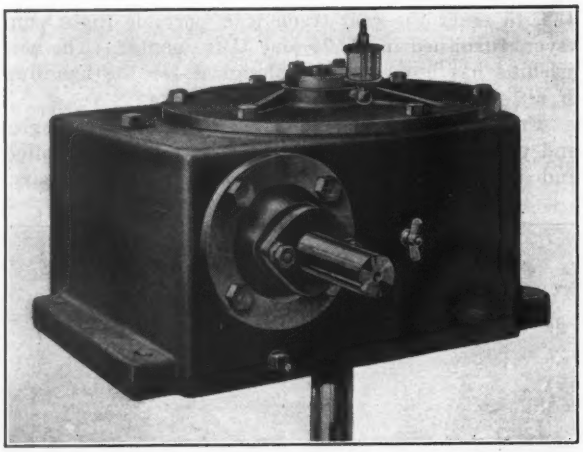
The head shaft is provided with bronze-bushed take-up bearings, held securely in angle guides and adjusted by screws. The foot sprockets are bronze bushed and revolve on a fixed shaft locked in place. The head shaft bearings and foot sprockets are lubricated through their shafts by Alemite fittings. The motor is completely enclosed by a sheet-metal housing and all gears are pro-

tected by guards. The head shaft is driven from a countershaft with suitable reduction gearing by a 5-hp. motor. Countershaft bearings are of the self-lubricating type (graphite-bronze). Raising and lowering mechanism for the conveyor is a chain arrangement of worm gearing and drive.

This machine may be operated in conjunction with an overhead I beam trolley, chain block and bail. It may also be fitted with a screening chute and screens of the woven wire or bar type, depending upon the material to be handled.

Speed Reducer for Vertical Drives

IMPROVED VERTICAL type heavy duty worm gear speed reducer that is made to allow for vertical driving with the drive shaft projecting at either top or bottom, has recently been announced. As shown, the housing is of high grade gray iron, of ample size, provided with a large oil cooling and heat radiating chamber. Timken bearings support both sides of the gear shaft. The worm shaft is mounted on double Timken bearings on one side, and Norma Hoffman roller bearings on the other. This bearing arrangement is intended to insure proper operation and the absorption of radial and end thrust loads, to eliminate excessive heating and to reduce wear of both the worm and gear.



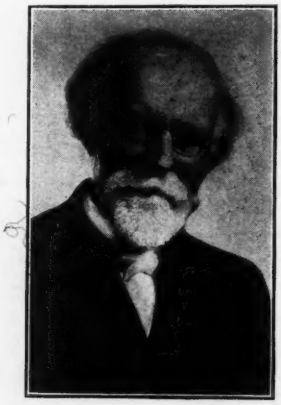
SPEED REDUCER WITH VERTICAL DRIVE SHAFT

Gear shafts are 0.40 carbon steel, carefully ground to size, and made oversize to withstand emergency strains and starting loads. Worms are made integral with worm shafts of S.A.E. 3140 chrome nickel steel, generated, heat treated, ground and fully relieved. Gears are made of high-grade phosphor bronze, the larger sizes made up of a bronze ring, shrunk on and keyed to a cast-iron spider. Twenty-degree to 30-deg. pressure angle teeth are standard, depending on the number of teeth in the worm and gear, and all gears are made with amply wide faces. This reducer, made by the D. O. James Mfg. Co., 1120 West Monroe St., Chicago, Ill., is especially intended for drives for mixers, agitators, disc feeders and other equipments that rotate on a vertical axis.

Death of John E. Lonergan

JOHN E. LONERGAN, head of J. E. Lonergan Co. of Philadelphia, Pa., died suddenly on October 23 at Sacramento, Calif. He was 87 yr. old. Mr. Lonergan had apparently been in good health when he went to California about three weeks before his death, which was caused by a sudden attack of bronchial pneumonia. Despite his age, Mr. Lonergan was active in the conduct of his business and he was also interested in several other industrial enterprises.

He was born in Nicholastown, Tipperary, Ireland, and came to this country when still young, settling in Philadelphia in 1875. He was a director of the Beneficial Savings Funds Society, a member of the Manufacturers' Club, Holy Name Society, Society of St. Vincent de Paul, Friendly Sons of St. Patrick and a life member of the Catholic Historical Society. He was an active figure in the Catholic Church, a member of the Knights of Columbus and in 1921 he was appointed a papal chamberlain by the Pope. Six years ago, he was one of the leading figures in the Forty Niners' celebration in Sacramento, Calif., where, as one of the features of the program, he again sat at the throttle of Locomotive No. 1 of the Central Pacific Railway, which he had operated in 1869. Mr. Lonergan donated $100,000 toward the establishment of an engineering school at St. Joseph's College, and also contributed largely to the building of the St. Matthias' Church in Bala, Pa., where he resided.



10,000-Horsepower Plant for 1800 Lb. Pressure

OF UNUSUAL interest to industrial and public service companies is the project announced by the Philip Carey Mfg. Co., Cincinnati, Ohio, to construct at the Lockland, Ohio, works a boiler and power plant designed for 1800 lb. steam pressure. This will be the highest steam pressure used in America, and the plant is said to be the largest high-pressure steam plant in the world. W. E. S. Dyer, consulting engineer, Philadelphia, Pa., will design and have charge of the construction of the new work.

High-pressure steam generating equipment will be furnished by Combustion Engineering Corporation of New York, and will have integral economizers, water-cooled furnace walls, air preheaters and pulverized fuel

equipment. The main generating units will consist of two 5000-hp. vertical triple-expansion, direct-connected engines, operating with 1400 lb. pressure at the throttle, at a temperature of 800 deg. F. and exhausting against 60 lb. back pressure above the atmosphere. To each engine will be direct connected a three-phase alternator.

All orders for equipment for this plant will be placed with American manufacturers, except for the main engines which will be furnished by A. Borsig of Berlin, Germany.

News Notes

PEABODY ENGINEERING CORP., New York City, has appointed Walter Castanedo, Inc., 1115 Maritime Bldg., New Orleans, La., as its agent in New Orleans and Mississippi.

CUTLER-HAMMER MFG. CO., Milwaukee, Wis., has announced the appointment of N. L. Mortensen as chief engineer for the company effective September 1. T. E. Barnum, former chief engineer, has been appointed consulting engineer for the company, in which position his attention will be given to engineering problems and outside engineering relations. Mr. Mortensen has been with Cutler-Hammer Mfg. Co. for 21 yr., the last five as assistant to Mr. Barnum.

S. C. BLOOM and Charles F. Kamrath have joined forces as Bloom & Kamrath to conduct a consulting and architectural engineering business at 330 S. Dearborn St., Chicago, Ill. Special attention will be given to refrigeration and air conditioning for buildings and industrial plants, in which field both men have had long experience and are recognized as authorities.

PRAT-DANIEL CORP., New York City, announces the removal of its headquarters to larger offices at 183 Madison Ave., New York City.

LOWELL S. MONROE, formerly with the Electric Controller & Mfg. Co., has joined the staff of the Copperweld Steel Co., Glassport, Pa., as engineer in charge of service data. Mr. Monroe is a graduate electrical engineer from the University of Michigan, afterwards taking post-graduate work at Ohio State University. He was for some time with General Motors Co. and will now be engaged in developing data on sag in overhead lines, vibration in bonding wires, endurance of guy wires, resistance of earth grounds and the like.

IN THE SHOPS of Busch-Sulzer Bros. Diesel Engine Co. recently an interesting sight was two 4000-hp. marine engines under test, a 3750-hp. stationary engine in process of erection, a 1000-hp. engine on the test bed and a 225-kw. generating unit being removed from the test bed by overhead crane. This busy scene was typical, as the shops have been operating 23 hr. a day with three shifts during 1928.

ANNOUNCEMENT IS MADE that after December 1, Power Plant Equipment Co., 1737 Walnut St., Kansas City, Mo., will be known as The Marley Co. This alteration has been made to associate more closely the company name and the trade name of its products. It is, however, a change in name only, as the same personnel, without exception, will still direct its activities. In addition, to improve the service to users of its products in the East, a direct branch office has been established at 342 Madison Ave., New York City.

CHARLES BRUCE WHITE, Chicago representative of the Cochrane Corp. and vice-president and general manager of the Cochrane Engineering Co. of Chicago, died on October 16 at his home at 6956 Jeffrey Ave., Chicago, Ill. Mr. White was born in Nova Scotia in 1864. His first positions were with the old Edison and Thomson-Houston companies; later, about 1891, he was in charge of the building of some of the first electric railroads in the southern part of the country. In 1898 he became chief electrician for the Calumet St. Railway of Chicago, later entering the service of the Western Electric Co. as a salesman. In 1900 he was manager of the Sprague Electric Co. branch office at St. Louis, Mo., and in 1901 became associated with A. Sorge, Jr. & Co., which was then representing the Harrison Safety Boiler Works and which is now the Cochrane Corp.

THE AMERICAN ICE CO., Philadelphia, Pa., is concluding arrangements for consolidation with the Atlantic Ice & Coal Co., Atlanta, Ga., both companies to be operated under one executive management. The Atlantic Co. operates 35 plants in 27 Southern cities located in Georgia, Tennessee, Alabama and Florida with a gross output of about 800,000 t. of ice per year with total revenues amounting to more than $5,000,000. An expansion program will be carried out in connection with the consolidation including increased facilities in different cities.

Catalog Notes

EXPANSION STEAM TRAPS are fully described and illustrated in a new bulletin, No. 828, just issued by W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. These traps are designed for pressures from 0 to 300 lb. and are recommended for draining all industrial appliances using steam. Details of the trap are shown with tables of capacities, which range from 437 lb. per hr. for a ½-in. trap at 100 lb. pressure to 1856 lb. per hr. for a 2-in. trap at 100 lb. pressure.

INSTALLATION of industrial furnaces and ovens is described in bulletin No. 108, just issued by the Celite Products Co., 1320 S. Hope St., Los Angeles, Calif.

"PRESENT AND FUTURE OF THE GAS INDUSTRY and the Relation of the Engineer to Its Progress" is the title of an address by Walter C. Beckjord, vice president and engineer, American Light & Traction Co., presented as one of the lectures on engineering practice on April 25, 1928, at The Johns Hopkins University School of Engineering, Baltimore, Md. This address is reprinted in a 34-page bulletin sent out by the university.

BEARING METALS for all services, made by a new process that is intended to produce better mixture and improved operating qualities, are described in a four-page folder sent out by the Invincible Bearing Co., Sandusky, O.

ONE HUNDRED AND EIGHTY-FOUR bucket elevators of different styles or sizes, with capacities from six and one-half to 750 t. an hour are noted in the new bucket elevator catalog No. 465, now ready for distribution by The Jeffrey Manufacturing Co., Columbus, Ohio. Thirty pages of engineering drawings illustrate the many types of chains, buckets and casings used in standard Jeffrey elevators; 22 photographs show the elevators doing almost every sort of work an elevator may perform. The catalog also lists typical materials, giving their weights per cubic foot of volume and designing the type of elevator best suited to lift them.

Power Plant Construction News

Ala., Sylacauga—The Avondale Mills, Inc., Birmingham, Ala., plan installation of power equipment in connection with proposed addition to cotton mill at Sylacauga, entire project to cost close to $100,000.

Calif., San Francisco—R. N. Nason & Co., 151 Botrero Avenue, plans installation of power equipment in proposed five-story addition to paint factory, entire project to cost about $100,000. Engineering department of company is in charge.

Ill., Chicago—The W. F. Hall Printing Co., 4600 Diversey Avenue, will install electric power equipment in proposed new plant addition reported to cost more than $500,000. R. M. Eastman is president.

Ill., Chicago—The Stewart-Warner Speedometer Co., 1828 Diversey Parkway, will install power equipment in new ten-story factory at 2825 North Lincoln Street, to cost about $300,000, for which plans have been filed.

Ind., Evansville—The Graham-Paige Motor Co., Crown Avenue, has filed plans for construction of a one-story power plant at its local body-building factory to cost close to $70,000, with equipment. C. M. Garland, 38 South Dearborn Street, Chicago, Ill., is architect.

Ind., Indiana Harbor—The Youngstown Sheet & Tube Co., Youngstown, Ohio, will install power equipment in connection with extensions in steel mill at Indiana Harbor, entire project reported to cost more than $2,000,000. James A. Campbell is president.

Ind., Indianapolis—The Department of Health, Stokers Building, is having plans drawn for a new power plant at the City Hospital, reported to cost about $400,000, with equipment. R. Frost Daggett, Continental Bank Building, is architect, and C. R. Ammerman, last noted address, engineer.

Ind., Indianapolis—The Progress Laundry Co., 428 East Market Street, has filed plans for two-story addition to boiler plant to cost about $30,000. The Commercial Testing & Engineering Co., 37 West Van Buren, Chicago, is engineer.

Ky., Frankfort—The Kentucky Cement Corporation, recently organized, care of the Hunt Engineering Co., New York Life Building, Kansas City, Mo., plans construction of boiler plant and installation of power equipment in connection with proposed new mill at Frankfort. Entire project will cost more than $1,500,000. F. B. Drew is president; engineering company noted will prepare plans.

Ky., Greenville—The Greenville Ice Co. will proceed with construction of one-story ice-manufacturing plant on Main Street reported to cost close to $30,000, with equipment.

La., New Orleans—The Shreveport Oil & Refining Co., Shreveport, La., will install power equipment in connection with its proposed new refining and distributing plant on waterfront at New Orleans, entire project to cost more than $600,000.

La., Oakdale—The Louisiana Public Utilities Co., Lafayette, La., is having plans drawn by Gannett, Seelye & Fleming, Inc., 600 North Second Street, Harrisburg, Pa., engineer, for rebuilding of portion of electric power plant and ice plant at Oakdale, recently destroyed by fire with loss reported at close to $100,000.

Md., Baltimore—The Maryland Creamery Co., 1726 East Platt Street, will install power equipment in proposed three-story ice cream plant on Register Street, entire project to cost about $200,000. The McCormick Co., 121 South Nagley Street, Pittsburgh, Pa., is architect and engineer.

Mass., Malden—Swift & Co., 60 North Market Street, Boston, plans installation of power equipment and refrigerating machinery in proposed new meat-packing plant at Malden, entire project to cost close to $80,000. Headquarters are at Chicago, Ill.

Mich., Detroit—The Ajax Bolt & Screw Co., 6623 Gratiot Street, plans installation of power equipment in connection with proposed rebuilding of plant, recently destroyed by fire with loss reported in excess of $300,000; a new boiler house will be built.

Mich., Muskegon Heights—The Campbell, Wyant & Cannon Foundry Co., will install power equipment in connection with expansion and improvement program to cost about $500,000.

Minn., Austin—The City Council, Water and Light Board, is planning the rebuilding of municipal light and power plant recently damaged by a tornado, with loss reported at close to $100,000, including equipment.

Minn., Hopkins—The Minneapolis Threshing Machine Co. will install power equipment in a new one-story addition to local plant, entire project estimated to cost about $100,000.

Mo., Kansas City—The Cudahy Packing Co., Union Stock Yard, Chicago, Ill., has completed plans for construction of cold storage and refrigerating plant at local meat-packing plant, to cost more than $100,000, with equipment.

Mont., Baker—The Montana-Dakota Power Co., Miles City, Mont., has approved construction of new steam-operated electric power plant at Baker, reported to cost more than $50,000, with equipment.

N. C., Belmont—The Belmont Ice & Fuel Co. is considering extensions in ice-manufacturing plant to increase capacity from 20 to 40 tons per day, reported to cost in excess of $25,000. R. L. Stowe is president.

N. J., Hasbrouck Heights—The Fokker Aircraft Corporation, 110 East Forty-second Street, New York, now being reorganized with additional capital of about $4,000,000, will install power equipment in connection with proposed extensions in plant at Hasbrouck Heights, and Wheeling, W. Va., as well as in new plant unit to be located near Los Angeles, Calif.; entire construction program reported to cost more than $1,500,000.

N. Y., Brooklyn—The Miller Parlor Frame Co., 266 Maujer Street, plans installation of power equipment in new two-story factory on Orient Avenue, to cost about $150,000. S. J. Fox, 66 Court Street, is architect.

Ohio, Akron—The Goodyear Tire & Rubber Co., Akron, will install power equipment in connection with an expansion and improvement program at local mill and other points to cost more than $7,500,000. Work will include a new mill on site to be selected in the South, to include a steam power house; also, initial addition to Akron mill, recently reported in these columns.

Pa., Ambridge—The A. M. Byers Co., 235 Water Street, Pittsburgh, will install power equipment in projected wrought iron pipe plant at Ambridge to cost more than $500,000 with equipment.

Pa., Philadelphia—The United States Gypsum Co., 300 West Adams Street, Chicago, Ill., will install power equipment, including boiler plant, in connection with proposed new mill at Fifty-sixth Street and Schuykill River, Philadelphia, to cost more than $1,000,000. The Morton C. Tuttle Co., 31 St. James Avenue, Boston, Mass., is engineer.

S. C., Greenville—Albert Lewis, Greenville, and associates plan construction of one-story ice-manufacturing plant, 75 x 100 ft., on Pendleton Street, to cost approximately $70,000, with equipment.

S. D., Timber Lake—The Timber Lake Lighting Co. is considering the installation of additional equipment at local power plant for increased output, including a 60 hp. engine and accessories.

Tenn., Chattanooga—The Champion Knitting Mills, Inc., Main Street, will install power equipment in connection with proposed extensions and improvements in plant to cost close to $100,000.

Utah, Murray—The Rocky Mountain Packing Corporation, Murray, plans installation of power and cold storage equipment in proposed new one and two-story plant to cost about $200,000.

Vt., St. Johnsbury—The American Fork & Hoe Co. has approved plans for construction of one-story power house in connection with a new addition to its local plant, entire project reported to cost more than $70,000. Headquarters are in Keith Building, Cleveland, Ohio.

Wash., Seattle—The Puget Sound Glass Co., Anacortes, Wash., plans installation of power equipment in proposed new plant at Seattle, entire project reported to cost more than $200,000.

W. Va., Wellsburg—The Pillsbury Flour Mills Co., Minneapolis, Minn., plans installation of power equipment in connection with a projected mill at Wellsburg, W. Va.